THE JOURNAL OF RADIOLOGY

Vol. V FEBRUARY, 1924 No. 2

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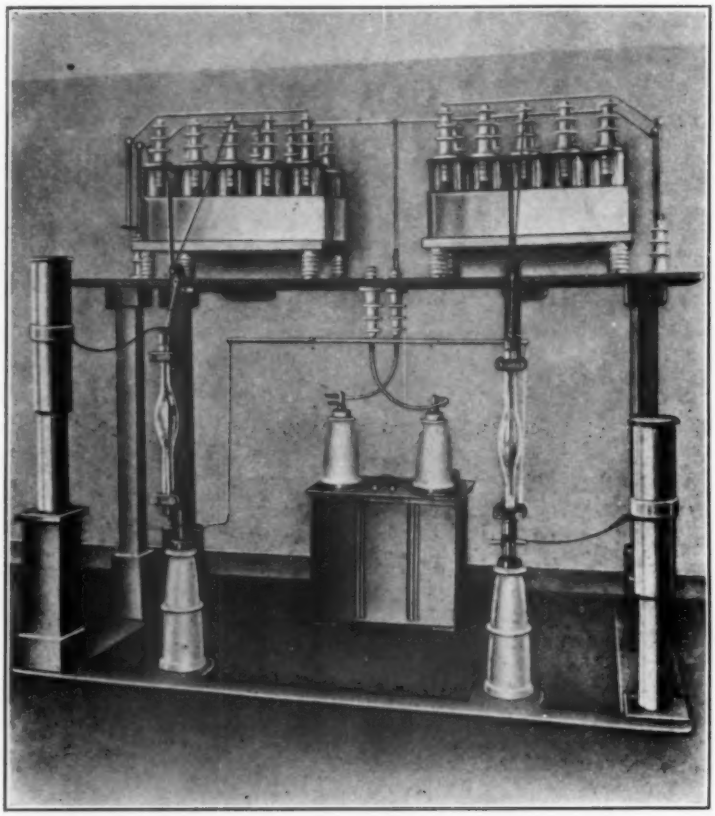

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The JOURNAL OF RADIOLOGY
Omaha, Nebraska
VOL. V FEBRUARY, 1921 No. 2

Misplaced, Unerupted and Impacted Teeth

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MISPLACED, unerupted and impacted teeth occur so frequently and cause so many different complications that we think it is important to consider them at this time.

Embryology

In order to have a clear understanding of the reason for misplaced teeth it is well for us to review briefly the salient points of the early development of the jaws and teeth.

The upper jaw, it will be recalled, is formed by a portion of the first visceral arch on either side uniting in front with the nasofrontal process. As development advances, the face and nose are formed by further fusion of these parts with the nasofrontal process. The upper jaw develops a ridge along the outer portion, which forms the cheek, and another ridge on the inner portion, which forms the gum. On the lingual surface of the gum a shelf develops and grows outward toward the midline and forms the palate which separates the nasal cavity from the mouth. At the time that the palate is growing toward the midline, the tongue, which earlier in embryonic life occupies the whole naso-oral cavity, recedes and allows the palate to fuse in the midline. Failure of the tongue to recede probably accounts for congential cleft palate. After the nasal cavity has been separated from the mouth by the palate an evagination takes place on the lateral part of the nasal cavity on either side, and this forms the antrum of Highmore.

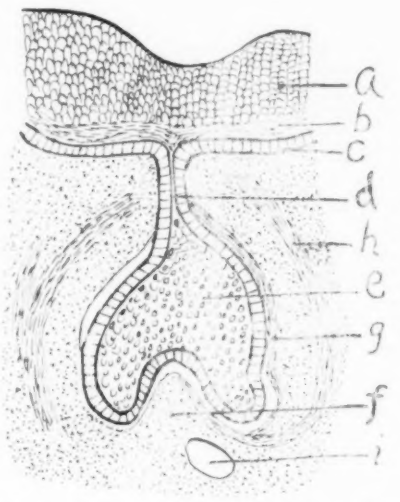

Fig. 1—Tooth germ of pig embryo (after Frey and Thiersch): *a, b, c*, layers of thickened oral epithelium, showing dental groove on surface; *d*, epithelial ingrowth, the end of which expands into the enamel sac; *e*, enamel organ; *f*, dental papilla; *g* and *h*, internal and external layers of the follicle wall; *i*, blood vessel.

The lower jaw is formed by the caudal portion of the right and left first visceral arches which fuse in the midline. As the jaws develop there occurs a row of evaginations of the ectoderm on both the upper surface of the lower jaw and the under surface of the upper jaw. Each evagination forms what is later called the tooth bud, an evagination taking place for each tooth except the permanent molars. The row for the deciduous teeth is placed slightly to the buccal side of the jaw, while the row for the permanent teeth is placed slightly to the lingual side of the jaw. For the first molar there occurs a single evagination and on its distal surface a bud forms for the second molar, and another for the third molar. In birds, tooth buds are present in the jaws for all teeth except the second and third permanent molars.

Each evagination grows deeper into the jaw until it forms a flask-like shape, the neck finally being pinched off. This leaves the tooth bud in proper place for each tooth. While this process is going on a vas-

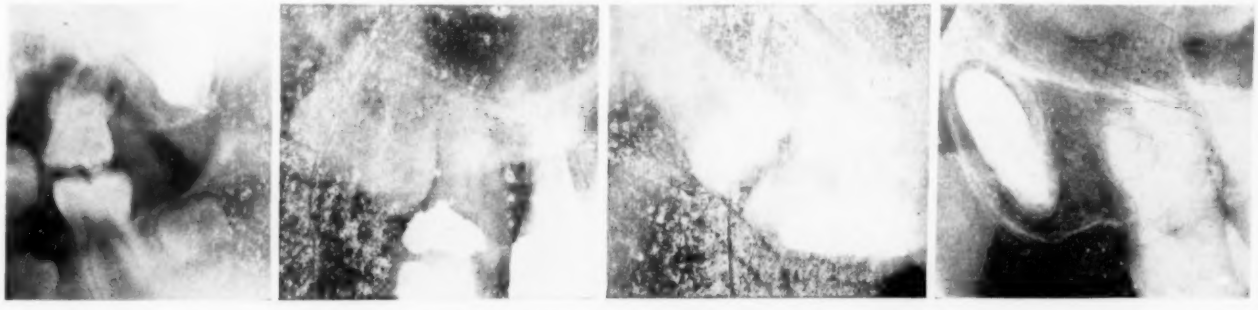

Fig. 2—Normal tooth bud of second lower molar showing the crown formed and the roots just beginning to develop. Upper second molar unerupted, crown pointing backward.

Fig. 3—Impacted upper third molar with erosion of the distal aspect of the second molar at the point of contact. Notice also that the first molar has been devitalized, probably in a vain search for the cause of the pain. This method of treatment is no longer necessary if x-ray examination is employed.

Fig. 4—Upper third molar impacted with crown directly against distal surface of second molar.

Fig. 5—Unerupted upper third molar with crown pointing upward and backward. This is an unusual position for the third molar.

Fig. 6—Upper third molar misplaced in nasal wall of antrum with the crown pointing backward, the tooth in the horizontal position.

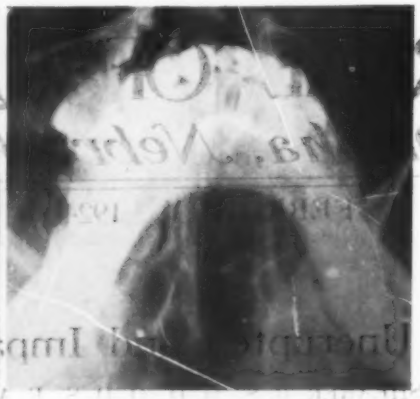

Fig. 7—Vertical view through the antrum of the same patient as in Fig. 5, proving the tooth was actually in the nasal wall of the antrum. Removed at operation.

cular structure of mesodermic tissue, the dental papilla, pushes upward against the bottom of the flask-like layer of ectodermic tissue and evaginates the bottom of the flask which gradually surrounds the mesodermic tissue with the exception of the extreme base. About this time the crown of the tooth has begun to form and the roots have started to develop. The ectodermic layer of the tooth bud forms the hard portion of the tooth, while the mesodermic layer from the dental papilla forms the pulp of the tooth.

It will be seen from this method of embryonic formation of the jaws and teeth that some of the cells of the ectodermic layer may be misplaced in any part of the maxilla or mandible. This accounts for the fact that misplaced teeth may be found anywhere in the upper jaw, the antrum, or in any position in the lower jaw.

Frequency

Clinical observation shows that the third molars are misplaced more frequently than any of the other teeth. It has been our observation that they may be found in the jaw impacted in various positions or unerupted so that the crown of the upper third molar points backward and upward, or even in the posterior wall of the antrum, or, as in one case, in the nasal wall of the antrum. The lower third molar may be found in any position, horizontal, crown pointing backward, upward or downward. The upper cuspid teeth rank second in frequency of misplacement. This is probably accounted for by two facts: (1) The naso-frontal process fuses with the first visceral arch at this point, giving more or less opportunity for misplacement of the tooth bud. (2) The upper permanent cuspids are very late in taking their place in the dental arch. Misplaced and unerupted bicuspids are very rare but they occur occasionally.

Symptoms

Misplaced, unerupted and impacted teeth frequently produce no symptoms. When they produce sufficient pressure either against another tooth or upon the mandibular nerve the patient will begin to notice pain. This pain is characteristized by a dull ache which is difficult for the patient to locate accurately and which is more often thought to be a neuralgia of the face than anything else. This ache may be at the site of the misplaced tooth but is frequently referred to other branches of the fifth cranial nerve so that in all cases of neuralgia of the face it is well to make a careful physical and x-ray examination of the teeth to determine whether misplaced teeth are a causative factor. Later development may be accompanied by swelling of the jaw at the site of the misplaced tooth.

Physical Findings

Physical examination of the mouth will frequently show an absence of the tooth in the normal location. If there has been swelling of the jaw at the site where the tooth should be, it will frequently show as a bulging of the jaw on the lingual or buccal surface. Misplaced cuspids can frequently be felt in the palate. Molar teeth which are misplaced will frequently give no physical findings except their failure to appear. In all of these types of cases the x-ray findings are of the greatest clinical value, for not only do they show the location of the misplaced tooth but they identify it, showing whether there has been an erosion of a neighboring tooth and whether the misplaced tooth is pressing directly upon the nerves in the jaw.

We feel that the x-ray examination is the most important part of the examination and that it contributes the greatest amount of information in arriving at the diagnosis.

Treatment

In the young, when teeth are misplaced or unerupted, orthodontic methods will frequently bring them

Fig. 8—Lower third molar impacted against the second molar with erosion of the distal surface of the second molar at point of contact.

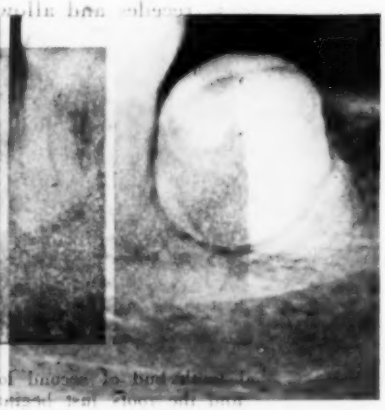

Fig. 9—Lower third molar impacted with crown pressing squarely against the distal surface of the second molar.
Fig. 10—Lower third molar resting transversely in the jaw.

down into proper position. In the adult, however, surgical treatment must frequently be employed. The type of operation used will depend upon the tooth which is under consideration but the surgical principles underlying the operation are the same for all.

Briefly, these principles may be stated as follows:

1. The field of operation should be rendered as nearly aseptic as possible.

2. Nerve block anesthesia with novocaine, *the patient in the horizontal position*, is the choice in adults.

3. The line of incision should never injure the soft tissues adjoining the cemento-enamel junction of sound teeth in the field of operation, and it should avoid the blood vessels supplying the flap.

Fig. 11—Lower third molar impacted in the ramus of the jaw. Notice the area of bone absorption around the distal surface. This is usually due to infection gaining entrance along the upper surface of the crown and steadily working downward along the distal surface.

Fig. 12—Lower third molar resting in the ramus of the jaw with the crown pointing downward and forward. This is an unusual position.

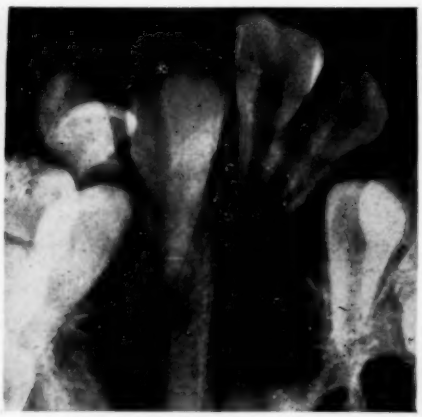

Fig. 13—Impacted upper cuspid in the usual position for this type.

Fig. 14—Both upper cuspid teeth impacted. On the right side of the figure there is a supernumerary cuspid tooth present, not a deciduous tooth as might be thought at first sight.

Fig. 15—An upper cuspid tooth misplaced in the plate with the crown pointing directly backward. An uncommon position.

4. After the incision has been made the mucoperiosteum should be laid back sufficiently to give an ample working field for the bone work.

5. The overlying bone should then be removed, carefully exposing the misplaced tooth.

6. The tooth should then be lifted carefully from its bed without injury to other teeth, to the mandibular nerve or other vital structures.

7. The bone margins should then be carefully smoothed.

8. The mucoperiosteal flap should then be closed with horsehair sutures.

9. If a large cavity must necessarily remain after operation provision should be made for daily irrigation between the sutures at one point.

10. Where the work is properly done there should be no febrile reaction and the wound should heal by primary union.

These principles when coupled with the technique suitable for each case and applied by an oral surgeon of experience will result in maximum good results and minimum bad results. So universally can primary union be accomplished in the mouth that no one should be content to have an open infected wound in the mouth following the removal of a misplaced tooth. Proper application of the above surgical principles and technique will insure the absence of any fracture or dislocation of the mandible as a complication. Brute force has no place in surgery of the mouth; the most careful technique coupled with gentleness in handling the tissues will yield the greatest success.

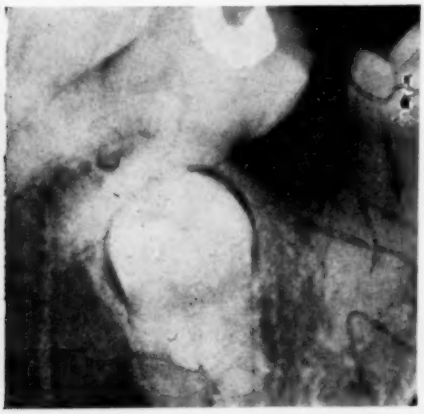

Fig. 16—An upper second bicuspid tooth misplaced in the palate. This type is even more uncommon than that shown in Figure 15.

Fig. 17—A lower second bicuspid tooth impacted against the mesial surface of the first molar. This is a very infrequent type.

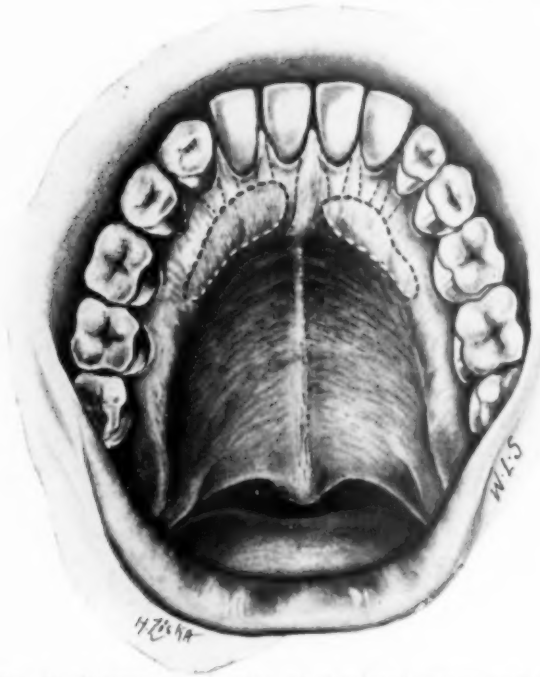

Fig. 18—Diagramatic drawing of mis-placed upper cuspid tooth resting lingual to the roots of the lateral incisor tooth.

Fig. 20—Drawing showing how the margins of the bone are smoothed, leaving no rough edges after the removal of the teeth.

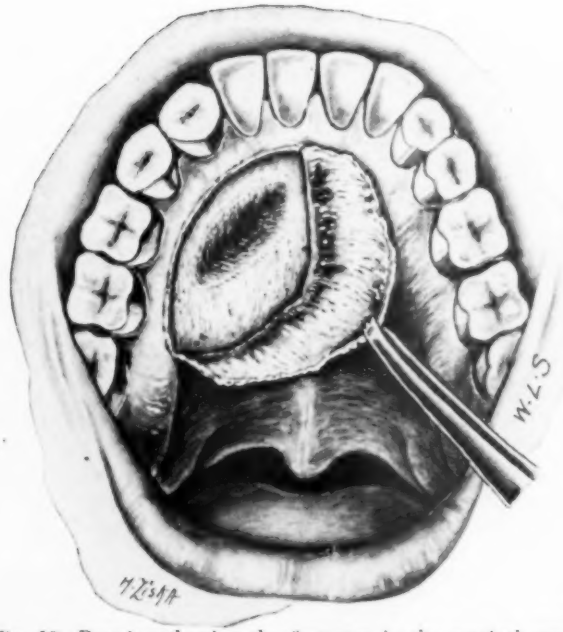

Fig. 19—Drawing showing the first step in the surgical removal of such a tooth. Incision is made close to the teeth, leaving just enough mucoperiosteum for suturing. This incision involves only the terminal branches of the descending palatine artery, thereby avoiding excessive hemorrhage and minimizing danger of slough of the flap.

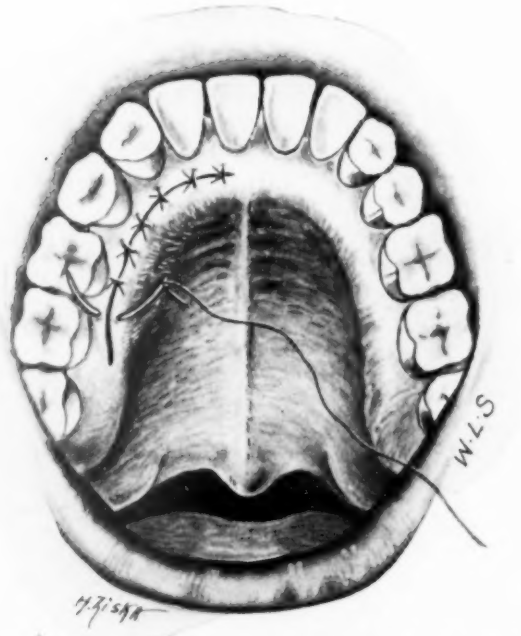

Fig. 21—Drawing showing how the mucoperiosteal flap in the palate is closed with interrupted horsehair sutures. With this technique there is usually no depression in the palate and usually no sloughing.

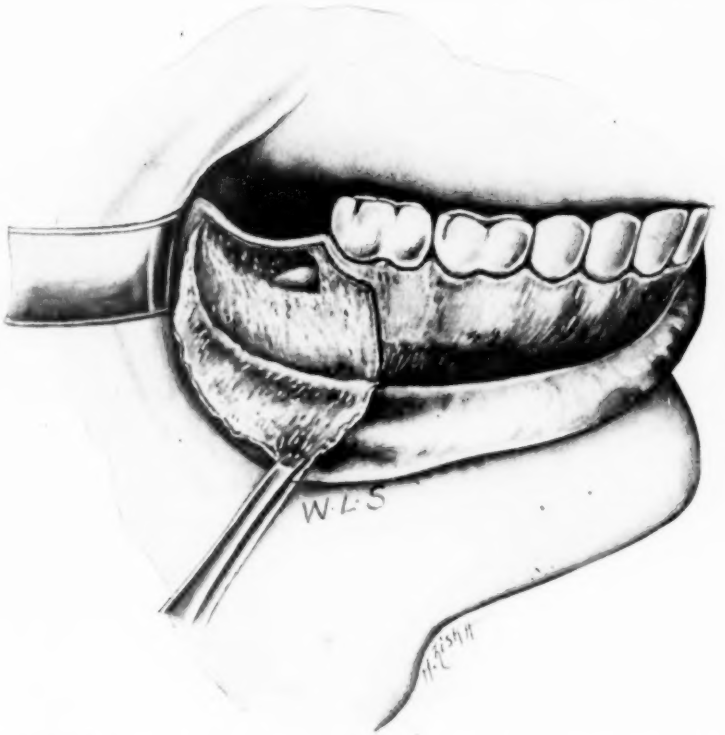

Fig. 22—Drawing showing the method of making the mucoperiosteal flap when removing an impacted lower third molar. The cemento-enamel junction of the sound tooth is carefully avoided by curving the incision.

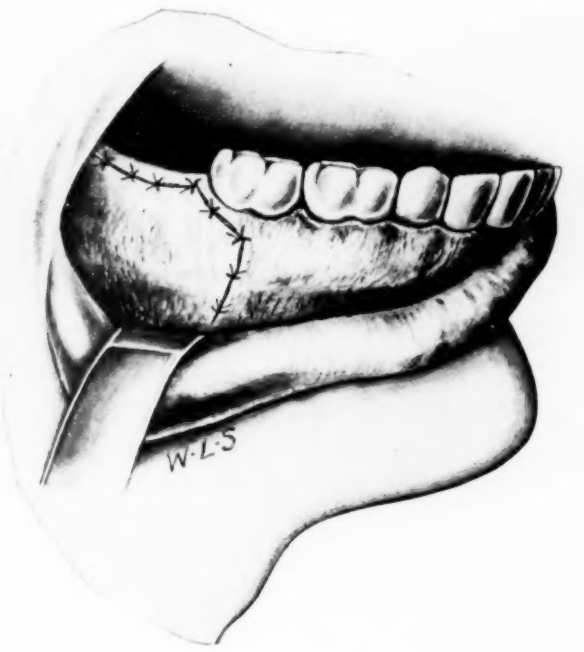

Fig. 23—Drawing showing mucoperiosteal flap closed with interrupted horsehair sutures.

The Roentgen Ray as an Aid to Diagnosis in Cardiac Lesions*

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IN the past, the diagnosis of cardiac and allied lesions has rested on three main premises: First, the clinical history; second, the physical examination; third, the new laboratory tests at our disposal. Within the past ten years there has been added a fourth means as an adjunct, that of the roentgen ray. It must be remembered, and I wish to emphasize this statement, that this is but an adjunct and used alone cannot be expected to produce correct diagnoses. The clinical history and the physical examination still play as important a part as ever in the diagnosis of this type of disease. We now have an additional accessory to add more fully to our knowledge along this line and to enable us to estimate more satisfactorily the nature of the pathological deviation and the success of our attempts to correct this deviation and to attempt a return of the function to normal. The heart and allied vessels, situated as they are in the center of the thoracic cavity, and surrounded and to some degree encroached upon by air-containing lung tissue render at least one branch of the physical examination unreliable. Percussion means but little in this type of work, and that little but a relative comparison of the increase of cardiac dullness that may occur in the same case from time to time as treatment progresses. Shattuck[1] as early as 1915 demonstrated its absolute unreliability in a series of cases at the Massachusetts General Hospital. In this series of cases the patient's chests were thoroughly percussed and, after a definite conclusion was reached, the outline in the form of flexible wire was attached at the proper position to the patient's chest by adhesive and the patient then filmed at a distance at which it was definitely proved in advance that distortion was impossible. In no case did the outline by percussion agree absolutely with the cardiac outline by film. In many the two were relatively in agreement but, dependent on the amount of lung tissue intervening between the heart and chest wall, variations were present in every case. Thus save, as before stated, as a relative test, the usefulness of this branch of the physical examination has been proved unsatisfactory. Auscultation then remains the main portion of the physical examination giving valuable results; and all authors of text books on the subject of physical diagnosis warn against the difficulty often found in differentiating absolutely by auscultation a murmur of relative or temporary origin from one due to organic disease; and of the inaccuracy of diagnosis based solely on the time of an organic murmur. The roentgen ray gives us an added aid and places before our vision a definite impression of the actual manner in which the heart is working and enables us to visualize the actual conditions present and the way in which nature is striving to overcome the obstacles placed in her way.

*Received for publication May 7th, 1923.

Historical

The roentgen-cardiac examination originated in Germany. Groedel[2] is the first man who investigated cardiac volume and measurements in a scientific and systematic manner and his tables and systems of measurements, while unreliable and more or

less categorical, still form the basis for this type of examination. His first article appeared in various German publications as early as 1908, but his classical work[2] was printed in 1912. Other German roentgenologists of note whose efforts have helped establish this science are Dutler, Nohler, Holtzknecht, Gutman and Moritz. Among the French, Beclere, Barjon, D'Arcelin and Thoyer-Rozat are prominent, but to Vaquez and Bordet are due the credit of perfecting and introducing the newer practices of roentgenoscopy. They formulated the tables in use for the examination of the heart through the fluoroscope and by means of orthodiagraphic tracing and have placed this branch of cardiac examination on an equal if not a higher plane than that of film examination. In our own country, Claytor and Merrel in 1909 perfected a set of tables still in use. Bardeen and Van Zwaluwenburg, champion the French method and have perfected it. Bardeen's tables are used in the U. S. Army X-Ray Manual. Danzer, Holmes and Ruggles are additional names to be mentioned in this work as chief contributors, while the list of assistants is too lengthy to be given. Abroad, the roentgen-cardiac examination differs markedly in different countries. France, for example relies practically entirely on the roentgenscopic examination. Martinez[3] in a very interesting article on this subject reviews French studies and comments fully on this method. All French tables of cardiac value are based on this method and the system employed for computation of cardiac volume uses orthodiagraphy as its foundation. This consists of a fluoroscopic examination first and then a tracing of the heart shadow on a suitable medium. Germany and England are inclined to pay more attention to the film, or teleoroentgenogram as it is technically called. In this country the method commonly in use consists of a combination of the two methods above outlined, the heart being examined roentgenoscopically and portions or all of the tracing or orthodiagram drawn, and lastly a teleoroentgenogram made. This is the method advocated by Holmes and Ruggles[4] and used by them at Massachusetts General Hospital; by Martin[5], a student of theirs; by Van Zwaluwenburg[6] and by the majority of the leading roentgenologists throughout the country. It is also used in the cardiovascular service of the U. S. Army[7].

For this method the patient is first stripped to the waist and taken into the fluoroscopic room. He is placed between the tube and the fluoroscopic screen, facing the operator, with the target to screen distance fixed; the usual distance employed being twenty-four inches or sixty centimeters, as according to the French methods of orthodiagraphy all tables using the index of disappearance of the angle of the apex of the heart as the foundation for estimating cardiac volume are figured at this distance. The current is then turned on and the examination started; some definite routine being employed so that nothing of importance may be missed. The size and position of the cardiac shadow is definitely determined and the rhythm watched. As the impulses comprising the entire cardiac cycle are visible to the eye any arrhythmia, extra systoles, heart block or fibrillation can immediately be recognized and traced to the chamber from which the defect originates. In favorable cases the auricular systolic beats can be counted as opposed to the ventricular systolic impulses, and thus any irregularities in the number of the two determined. So, too, any of the various configurations characteristic of lesions of the various valves, chambers or portions of the heart can be detected and placed in their appropriate class. After the operator has satisfied himself that he has obtained all the information of value to him from the study of the posteroanterior silhouette, the aorta is examined from this position. Any sacculated enlargements which constitute the aneurysmal variety of dilatation are noted and carefully watched for impulses synchronous with the cardiac action. In this position the edges of the ascending aorta, the transverse portion of the arch and the first portion of the aorta are considered in proportion to the cardiac silhouette to determine whether any degree of regular dilatation exists. Next the aorta should be studied in an attempt to determine the presence of atheromatous plaques. Lastly, the edges of the shadow are marked with pencil on the screen, thus giving us the anteroposterior width of this vessel.

The patient is now directed to place his hands over his head, and is then examined in the two lateral positions. The right lateral is that in which the patient's left side is next the tube, and right side next the operator. In either lateral position there may be said, roughly, to be three main fields or divisions. The first, and most opaque is that of the spinal column; the midfield, which should light up on deep inspiration, is the posterior mediastinum, and the most anterior of the fields is the moderately cardiac silhouette. In the right lateral position, according to Overend[8], this latter is composed of three portions. The base is the right ventricle; the midsection mainly the right auricle, with the pulmonary vessles and the superior vena cava added thereto and the apex is composed of the ascending aorta, with the arch veering over the left, and the descending aorta leading therefrom. Crossing the clear area of the mediastinum in the center of the ventricular shadow is a slightly opaque band approximately one-half inch wide due to the shadow of the pulmonary vein. The patient is now rotated to the opposite lateral position, the left, in which the right side of the patient faces the tube and the left the operator. The same three fields described above are again visible. In this posture the cardiac shadow is made up of two sections: the left ventricle below and the left auricle above. The left auricle is crossed in its midsection by the opacity of the pulmonary artery. Above the cardiac shadow is the shadow of the aorta and the aortic arch. The patient is then rotated to the left lateral positions until the smallest diameter of the aorta is obtained, and as before, this is recorded by pencil on the screen as the lateral diameter of the vessel.

This concludes the roentgenoscopic examination. The patient is now ordered to stand firmly and quietly in a fixed position under the fluoroscope and the screen is locked in place. Over the screen is inserted either a piece of glass or a piece of architect's tracing paper the size of the screen. On either a line is drawn vertically and the screen adjusted with the vertical shutters over the tube almost closed, until this line reaches the point corresponding to the center of the spinal column. The tube carriage is now released so that the tube acts independently of the screen. The diaphragms over the tube are closed until only the central ray from the tube is obtained. With the tube thus screened down, the carriage is moved until the ray strikes one of the costrophrenic or costovertebral angles. Starting here, the line of the thoracic cavity, the clavicle, the pulmonary apex, aorta, cardiac configuration, costovertebral (cardiodiaphragmatic angle), are rapidly sketched in, the patient meanwhile breathing in a natural manner and the operator being care-

ful to use only the central ray of the tube. The other side is then sketched in as above described. Any changes that occur in the outline on deep inspiration and expiration are also included, and the orthodiagram is completed. The glass or paper is then set aside for future reference and the measurements previously taken of the two diameters of the aorta calculated in centimeters, and recorded thereon. Experiments made and measured after death have proved that this method used in trained hands will give a shadow tracing that represents accurately the size of the true cardiac shadow, together with the changes taking place in it during respiration.

The objection to orthodiagraphy is that it requires a certain amount of technical skill which not every one possesses, and those who do not are likely to get a tracing not entirely accurate, rather awkward, and certainly not smooth, and finished in its final appearance. The advantages of orthodiagraphy are its rapidity and flexibility in the hands of experts; and the ability to outline the apex accurately, and to include in the tracing the effects of the different phases of respiration on the cardiac silhouette. As a final step, a mark is now made on the patient's back, at the approximate center of the heart shadow to serve as a guide for centering the tube in taking the teleoroentgenogram.

The teleoroentgenogram, as its name implies, is a film of the cardiac silhouette. This film, in order to prevent distortion, is made at a distance of from six to seven feet from target of tube to film. The distance most generally used is that of two meters or seventy-eight inches. The positions used are either standing with the chest toward the film and back toward the tube, with the chest wall pressing against the cassette, or sitting in the same posture. Several swallows of water taken immediately before "shooting" the film, the patient being admonished to swallow air with the water, will often be of aid in outlining the apex, as the air infiltrates the stomach. Unless it is designed to catch the heart at some particular phase of its action, the time of the exposure is approximately one second so that both systolic and diastolic cycles may be included and the film is then a combination of both. Care must be taken that the patient is in proper position, parallel to the film and with the transverse diameter of the chest at right angles to the tube to prevent distortion from angulation. The shoulders should be rotated anteriorly. Respiration is allowed to continue during the exposure, provided that it is of moderate degree. The tube is centered at the level of the mark made on the patient's back. The advantages of the teleoroentgenogram are first the abolition of the personal equation and second that it gives a permanent record. The disadvantage is the difficulty of being certain of the apex of the heart and often of the point of junction of the left auricle with the left ventricle. After the film has been developed and dried, certain measurements are made which we will take up later.

Here it might be wise to give in detail the appearance of the normal heart under the ray. The cardiac silhouette is composed of a series of curves with convexity outward and intersecting each other, most of which can be easily and independently recognized. There are two on the right side and four on the left. Starting at the right cardiodiaphragmatic angle, the first and lowermost curve is rather large and well defined. It is the curve of this right auricle. Above it is the curve of the ascending aorta. On the left side the topmost curve is that of the arch of the aorta as it joins the descending aorta. The second is the curve of the pulmonary artery, below and to the outer side of which is the third or small curve of the left auricle, below which the lowermost curve is that of the left ventricle. This latter is again a large curve. Above in the midline can rarely be traced the curve of the arch of the aorta. On the ordinary orthodiagram of the normal chest the following points are usually distinguishable, if the tracing be properly prepared. From the apex of the chest to base thereof, the chest may be divided into three sections which successively increase in width from above downward. The first, or topmost, section is bounded above by the apices of the lungs and below by a line drawn transversely at the top of the crest of the arch of the aorta. It is bisected by the lower border of the clavicles. It contains no part of the cardiac silhouette. The midsection is bounded above by a transverse line at the crest of the arch of the aorta and below by another line drawn transversely at the junction of the curve of the ascending aorta on the right, and the junction of the descending aorta with the pulmonary artery on the left. This section contains that portion of the cardiac shadow dealing with the aorta. The lowermost section, which contains the heart proper, is bounded above by the base of the midsection and below by the diaphragm. Here the distance from cardiac apex to thoracic wall should approximate half the total distance of the left thoracic cavity.

For purposes of measurement, a teleoroentgenogram is marked as follows: First, a vertical line is drawn at the exact center of the vertebra to represent the midline of the body. Three points on the right and left sides of the cardiac silhouette are then selected and from them certain lines are drawn. On the right side these points from below upward are first the cardiodiaphragmatic angle; second, the point of the right auricle farthest to the right of the midline; and third, the point of junction of right auriclar curve with that of the ascending aorta. On the left three points are also taken. From below upward they are, first, the apex of the heart; second, the portion of the left ventricle farthest to the left; and third, the point of junction of the left ventricle with the left auricle. Using these points the following lines are now drawn: A line from the point farthest to the right of the right auricle at right angles to the body midline and connected to it; a similar line from the point farthest to the left of the left ventricle and at right angles and connected with the body midline; a line connecting the cardiac apex with the junction of the right auricle and ascending aorta; a line at right angles to this line and connected to it from the cardiodiaphragmatic angle; another line at right angles and connected to it, from the junction of the left ventricle with the left auricle. These lines give us the following information: The lines at right angles to body midline and extending to points farthest left and right of the cardiac silhouette give in their total the transverse diameter of the heart. The one extending to the right is known as "MR" and the one extending to the left as "ML." The line connecting the apex with junction of right auricle and ascending aorta is known as "L" and gives us the longitudinal diameter of the heart. The two lines at right angles to it, known as "X" for the one from the cardiodiaphragmatic angle, and "Y" for the one from junction of left auricle and left ventricle, together form "B" and give the auricular diameter of the heart. Finally a line is drawn from one edge of the aortic arch to the other giving the anteroposterior diameter of the vessel. Various lesions of various valves will change the diameter of these lines. In general the following two working rules may be laid down, neither is absolutely ac-

curate, but both will suffice in the average case: The first is that the relation of MR to ML is as 1:2. In other words, the diameter of the right auricle should be half that of the left ventricle. Second, the sum of MR and ML, the transverse diameter of the heart should approximate the width of the thoracic cavity as measured on film. This last rule is the work of Danzer[9], published in 1908. It has been most strenuously objected to by many eminent roentgenologists, who pronounce it unworthy. Bardeen[10], especially criticizes it and substitutes for it a series of formulae in which body weight, area of silhouette, age and sex all play a part. The main objection to it lies in the fact that any subdiaphragmatic enlargement causing pressure against the diaphragm and the heart will alter the normal position of the heart and thus change the result. In comparing cardiac areas as elicited from an orthodiagraphic drawing and from a teleoroentgenogram, a decided difference will be noticed. Kirshner and Kennicott[11], state, "In our own series the discrepancy between the planimeter of the orthodiagram and the planimeter measurement of the seven foot plate has been practically constant, the average being thirty per cent." They advocate the method of Van Zwaluwenburg, which relies on orthodiagraphy as the fundamental, and which they have slightly modified. This method consists of multiplying the long diameter of the cardiac silhouette, which is that diameter drawn through the center of the figure by the short diameter, erected perpendicularly thereto at the widest portion of the shadow. The figure then obtained is know as the *Product of Diameters* (POD) and is then divided by the corresponding value from a table of normal POD's on the basis of body weight. Their figures in the final analysis closely approximate the formulae of Bardeen, although their method is different. Thus we see that there are two general divisions. Those who use the method of Danzer, and consider a heart enlarged that exceeds half the internal measurement of the thoracic cavity and those who prefer the anatomical method of greater accuracy, as based on the formulae of Bardeen or the method of Van Zwaluwenburg. In general, it may safely be said that as a usual thing, Danzer's rule is a safe working rule and is applicable to practical working conditions.

Finally, the area of the cardiac silhouette is measured in one of two ways. Before measuring, however, the portions of the silhouette unfinished must be filled in with pencil. The area is then computed by planimeter, using the lines MR, ML, the body midline, and the known diameter of the aorta. A simpler method and one at the command of every roentgenologist is made by taking a large film, clearing off the emulsion by immersing in fixing solution, washing thoroughly, drying, and after it is dry ruling it with india ink so that it is ruled in squares, the area of each being one square centimeter. This is placed over the teleoroentgenogram and the squares counted, estimating the fraction of squares. This will give, accurately enough for all purposes, the area in square centimeters of the cardiac silhouette.

We will now consider in detail the more common forms of the various cardiac lesions as we see them on the screen and film. Aneurysms appear as irregular pulsating swellings of the ascending, transverse or descending aorta. Atheromatous plaques can only rarely be shown up in the aorta, but one would expect them and look carefully where this vessel is extremely tortuous. Regular dilations of the aorta usually involve the ascending aorta, and show an in-

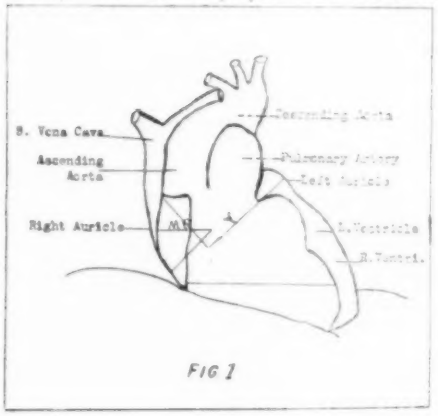

FIG 1

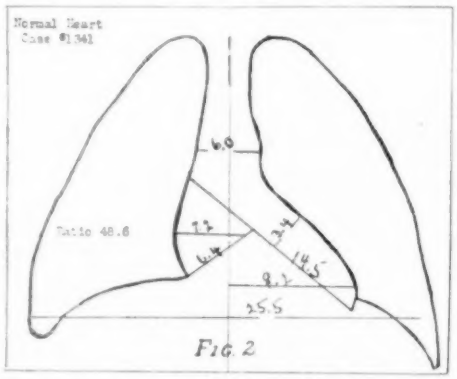

FIG. 2

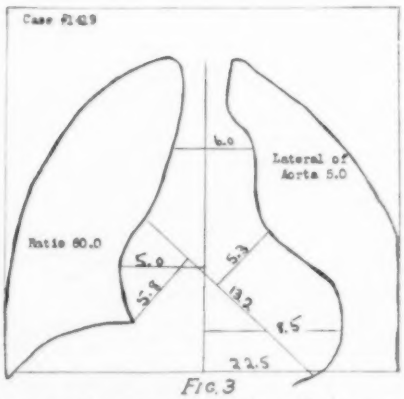

FIG. 3

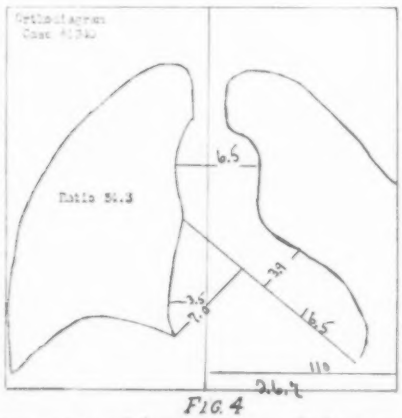

FIG. 4

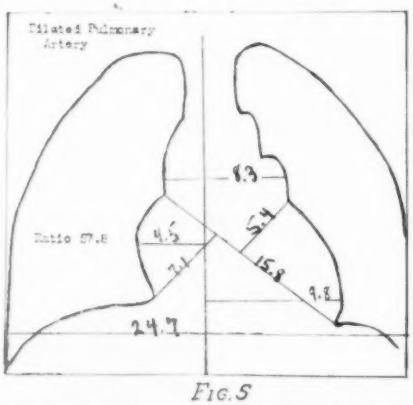

FIG. 5

Fig. 1—Diagramatic drawing of the component parts of heart and great vessels forming cardiac silhouette (after Martin).

Fig. 2—Orthodiagramatic drawing of a normal heart.

Fig. 3—Orthodiagramatic drawing of aortic configuration in child.

Fig. 4—Orthodiagramatic drawing—mitral configuration.

Fig. 5—Orthodiagramatic drawing illustrating dilated pulmonary artery.

crease in width of this portion of the cardiac silhouette. Inasmuch as they usually involve the aortic orifice, we generally find evidence of a lesion of this valve.

The two most common cardiac configurations are the mitral and the aortic configuration, corresponding largely to whether the enlargement is of the right or the left heart. A diagnosis of the exact type of lesion is impossible by roentgen examination alone, though each lesion of each valve possesses certain individual characteristics. In the mitral configuration the greater enlargement is to the left. If the ventricular curve is most enlarged we would ordinarily expect to find regurgitation, while if the auricular curve is the one most involved, the lesion suggested would be stenosis. A combined lesion would, of course, produce enlargement of both curves.

The aortic configuration is produced when the greater comparative enlargement is of the right heart. Usually, since in aortic lesions there is present a muscular hypertrophy of the left ventricle, it too is enlarged in the silhouette. In general, when the enlargement is marked one would expect a regurgitation, as pure stenosis does not produce so marked an enlargement of the cardiac area. In the aortic configuration the base of the heart is usually more rounded or egg shaped than in a lesion producing the mitral configuration.

Another condition frequently seen is that produced in cardiorenal disease. Here the enlargement is usually of the left heart with a blunt rounded apex and accompanied by an enlargement of the aorta, ascending arch and often including the descending portion.

Pericardial effusions produce a heart shadow which tends to be almost equidistant from the body midline, and is rounded or jug shaped. It is called the "Water Bottle Heart." Healed fibrinous pericarditis gives a triangular shadow, from adhesions produced, with the triangle almost bisected by the body midline.

Drop heart or ptotic heart occurs in long chested, thin individuals of the asthenic type who are prone to ptosis. While strictly not a disease of the heart, it is a result of undernourishment on the part of the individual. Formerly it was considered as absolutely diagnostic of a tubercular pulmonary infection. This is untrue. In many cases it occurs at a late stage, but here it is due more to the accompanying asthenia than to the disease proper.

Congential cardiac lesions usually show only one abnormal configuration. This is an enlargement of the pulmonary artery and is found in cases of patent ductus arteriosus. Here the heart is enlarged to the right and the pulmonary artery pulsates synchronously with the ventricles.

Diseases involving the myocardium producing chronic inflammation in time, also produce a change of the contour of the cardiac shadow. This usually takes the form of a ventricular enlargement with increase in the long diameter of the heart. This condition is found in prolonged cases of hyperthyroidism; and especially in senile cases, often accompanied by hypertension. In this class also belong the cases of nephritis, as well as any chronic infection affecting the myocardium. It might be wise to add that the roentgen ray gives no index of the physical calibre of the heart muscle. A weakened cardiac action under the screen does not essentially mean weakened myocardium, and vice versa. In many normal hearts the pulsations may be very slight, and yet the myocardium be functioning in a normal manner.

Specific lesions more generally effect the aorta producing aortitis in the acute stages of which the roentgen ray demonstrates no change until such time as there is dilatation of the aorta when the process becomes appreciable. This dilatation often, in fact one might say usually, involves the aortic valve producing aortic regurgation, with its attending roentgen signs.

Conclusions

1. Roentgen examination is of value in cardiac lesions, visualizing as it does the entire central cardiac system and permitting the examiner to see for himself the existing defects or departures from normal.

2. The combined method surpasses in value either of its components, giving a true model of the heart under conditions present at the time of examination.

3. Various cardiac configurations are strongly indicative of various cardiac lesions, but a specific diagnosis by roentgen ray alone of type of lesion and valve involved is hazardous, unreliable and untrustworthy.

4. Roentgen examination is the only means at hand for definitely establishing the exact size of the heart, more especially in relation to the intrathoracic cavity, and of each of the chambers composing the heart.

5. Two safe working rules for estimating cardiac size are, first, that the diameter of the left auricle should be half that of the left ventricle, and second, that the transverse diameter of the cardiac silhouette should be half that of the intrathoracic cavity.

6. Roentgen examination is at the present time the only reliable method for definitely establishing the existence of dilatation of the aorta, and determining the exact portion of the vessel involved.

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Use of Physiotherapy in Certain Orthopedic Conditions with Particular Reference to the Usefulness of the Actinic Ray*

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IT will first be necessary for me to qualify my remarks by making it clear that we are forced to use physiotherapy measures and the actinic ray in an extremely limited manner, because at the present time our hospital facilities give us no opportunity to use those measures on hospitalized cases except as they become ambulatory and can come to the office for these treatments. Therefore, the series of patients from which the study is made comprises strictly those that come under our office clinic.

From December 1st, 1921, to December 1st, 1922, a total of 110 patients were given 2,347 physiotherapeutic treatments. This of course includes massage, baking, muscular training, exercise, and mercury quartz lamp treatment, etc. This work is performed under our direction by our physiotherapeutist, Mrs. H. L. Johnson, who has had years of experience in taking care of these cases, not only in civil life, but in the army hospitals during the war.

Time honored principles have given us an opportunity to know what to expect from most of the various physiotherapy methods, however, the use of the quartz arc in orthopedic surgery is relatively new; and in reality this is the first survey that we have made of our accomplishments with this therapeutic agent, and therefore our statistics can only be considered in a general way, as the number of cases is relatively small, and our experience of the past year scarcely justifies more than a frank personal opinion. However, we have found that there are certain conditions in which the mercury quartz lamp can be used as a very dependable adjunct to our physiotherapeutic regime. We have worked out certain routines for the treatment of various conditions and have been able to follow these quite accurately.

Of the 110 cases 60 received the actinic ray. Twenty-six of the total number were fractures, of which eight had actinic ray treatment. The tables illustrate the types of fractures on which actinic ray was used.

Total No. Physiotherapy patients 1922 110
No. Treated by Actinic Ray 62

Fractures	Tot. PTT.	Actinic Ray
Potts	2	2
Humerus	5	0
Tib. & Fib.	4	0
Patella	1	1
Colles	5	0
Elbow	1	0
Femur	2	1
Spine	6	4
Total	26	8

Arthritis & neuritis	Tot. PTT.	Actinic Ray
Knee	10	2
Shoulder	7	2
Sacroiliac	12	9
Wrist	4	4
Spine	3	3
Subdeltoidbursitis	4	4
Total	40	24

Total No. Physiotherapy Patients 1922 110
No. Treated by Actinic Ray 60

Osteomyelitis	Tot. PTT.	Actinic Ray
Femur & Tibia	1	1
Femur	2	2
Fib. & Tib.	1	1
Humerus	1	1
Total	5	5

Burns	Tot. PTT.	Actinic Ray
Foot	1	1
Leg	2	2
Arm & Hand	1	1
Total	4	4

Miscellaneous	Actinic Ray
Varicose Ulcer	1
Open Wounds	8
General Stimulation	9
Sarcoma	1
Total	19

Fig. 1—Taylor back brace with sacro-iliac support. Furnishes adequate support to a patient suffering from saro-iliac trouble while under physiotherapeutic treatment. This brace is also used during convalescence of patients having back injuries and fractures.

Under the diagnosis of arthritis and neuritis, there are forty cases, twenty-six of these had the actinic ray.

In this series have been included four cases of subdeltoid bursitis which have been exceedingly interesting in their outcome.

There have been five cases of osteomyelitis, on all of these the actinic ray has been used with a certain definite amount of satisfactory results. Next we have a group of four burns. We have found the actinic ray of tremendous value in the treatment of this condition. Eight open wounds have received the actinic therapy with varying effectiveness. A single varicose ulcer of long standing is quoted in this series and was successfully healed by the actinic ray. After massive x-ray treatment by Dr. Roscoe L. Smith, a sarcoma of the femur had actinic therapy purely to relieve the severe pain, and in an effort to stimulate granulation at the site of previous operation. Nine other cases were

* Read at the joint meeting of the Interstate Society of Radiology and Physiotherapy, Omaha, December, 1922.

given general stimulative treatment with the quartz lamp.

In considering the series of fractures of which there were eight treated by the actinic ray, none of these received heliotherapy until the period of complete immobilization was over. That would bring the beginning of the treatments about six or eight weeks after the reduction of the fracture.

The application of the ray in these cases, particularly cases of the extremities, was to relieve the tenderness, promote stimulation of the skin and circulation in the region affected, thereby preparing the extremity for passive movement, massage, exercise and eventually diminishing the period of disability. Its relation to the treatment of fractures of the spine was to promote general stimulation of the entire system, relieve the soreness and stiffness in the back, and build up the general tone of the soft tissues in this region.

The one fractured femur is that of a man in his sixties who had had malunion with two and a half inches of shortening, on whom a subcutaneous osteotomy was performed and the leg brought down to within a half an inch of its normal length and immobilized by means of plaster of paris spica cast and traction. After eight weeks the cast was removed and a caliper splint applied. While in this splint physiotherapy treatment was begun. First the deep therapy lamp was applied to the region for twenty minutes, after which the quartz lamp was used over the entire extremity at a distance of eighteen inches, for a period beginning at two minutes and increasing the exposure daily to five minutes. Manipulative measures were immediately begun, particularly with reference to the knee movements, and after five or six daily actinic ray treatments the ray was discontinued and massage instituted.

A similar procedure was followed in the two Potts fractures. In these cases there had been considerable soft tissue damage. In the case of the fractured patella solid union did not take place for three months after operation, and the knee at the end of this period was extremely stiff and when manipulation was instituted there would appear a tremendous amount of fusion in the knee. For that reason the actinic ray was applied and after a few treatments the swelling began to disappear and manipulation was accomplished by less pain, and massage could be readily instituted. The ultimate results in this group were in every way satisfactory, and we feel that the actinic ray aided (1) in the stimulation to the circulation of the extremities, (2) it had a retarding influence on the effusion in the joints near the site of fracture, and (3) it reduced the amount of of pain and tenderness associated with early passive motion and manipulation. In this way it perhaps aided in the absorption of scar tissue by more rapidly bringing the soft tissues to a more normal condition.

In the treatment of fractures of the spine both the dorsal and ventral surface of the trunk were treated with the actinic ray in the previously described manner. The treatment was instituted after these patients became ambulatory and wore a removable cast or brace. (Fig 1.) The period of aching and soreness usually seen as these cases become ambulatory was, we believe, shortened by physiotherapeutic treatments.

Of the four cases treated by the actinic ray, one of these is now under treatment and we have not been able to determine what the result will be. Two of these have returnd to light work within three months after their injury, which is an unusually short time for such injury. Another one of these series had a bone graft operation, and the actinic ray treatment, we believe, diminished the amount of soreness during his convalescence.

Under the heading arthritis and neuritis there are 40 cases, of which 27 received actinic ray treatment. (these two diagnoses are considered together because their general treatment is somewhat alike, and comprises, (1) immobilization of the joint affected in a certain classical position, (2) the removal of possible foci of infection and (3) internal medication. In each case of this group in addition to treatment of the

Fig. 2—Case of subdeltoid bursitis after physiotherapeutic treatment. When first seen some two months after the injury the arm could not be lifted from the side. In an aeroplane splint he brings the arm above the head with ease. The actinic ray was a valuable adjunct, we believe, to the treatment of this patient.

affected area, a certain portion of the trunk was exposed to the ray for the general stimulative affect. Of the ten knee cases that came under the observation of our physiotherapeutist, only two received the actinic ray. These two were active processes with swelling and extreme pain. The other eight knee cases were old arthritic cases that needed particularly massage, baking and manipulation. Seven of these conditions were localized in the shoulder, two of these were exposed to the actinic ray. There were four acute cases of arthritis of the wrist, all of which received the actinic ray with excellent results. Twelve sacro-iliac conditions come under this series, nine of which received the actinic ray. Six of these were women. All had an acute onset and with two exceptions had never suffered previous attacks. After the usual one to four weeks in bed with traction on the lower extremeties, double spica cast, or forcible manipulation of the sacro-iliac region, under anesthesia, and then a cast, the acute pain disappeared. As they become ambulatory these patients usually have some backache. Our method of treatment for such conditions is to expose the trunk and lower extremities to a stimulative dose of the actinic ray, while more vigorous application is used upon the lower portion of the back. Each case is protected by an adequate sacro-iliac brace (Fig. 1), and immediately upon the application of these measures the pain begins to disappear, and within a comparatively short time the patient is entirely relieved.

Of the three spine cases, two were postoperative bone graft cases, and were given the actinic ray as a local stimulative measure. Four subdeltoid bursitis cases are included in this series. All of these were greatly relieved by the treatment. Two of these followed injuries to the shoulder. The one, a young man, while lifting a heavy object slipped and injured his right shoulder and was unable to bring the arm away from the body, and suffered severe pain on movement in every direction. Roentgen examination was negative and in the region of the deltoid bursa there was extreme tenderness.

This condition when he was first seen had gone on for sometime, and the arm was a perfectly helpless limp object hanging by his side. He was placed under the care of our physiotherapeutic department, and an aeroplane splint was applied after a forcible manipulation under anesthesia. Then he received actinic ray treatments along with massage, passive motion, manipulation, and continued wearing his aeroplane splint for a period of three weeks (Fig. 2).

The arm immediately began to improve, and at the present time, although he still wears this splint, he can fully lift the arm from his side, over the head, and move it in every direction. A great measure of his rapid recovery is attributed to the actinic therapy to the shoulder region after his manipulation, and to wearing constantly the abduction splint.

A very thorough physical and clinical examination was made on each patient. All evidence of foci of infection were removed and every measure advisable for the rapid recovery of the patient was carried out.

Our conclusion regarding the effectiveness of the actinic ray in our series of acute arthritis and neuritis cases, is that after proper immobilization and medical treatment has been instituted, the actinic ray is of tremendous value. It first acts as a stimulant to the system in general, and secondly, has a definite influence in relieving the pain during the acute symptoms, in reducing the amount of effusion and swelling in the region effected and in hastening an ultimate cure. This class of cases has been benefited by its use probably more than any other class of cases in our series, except the burns and ulcers.

There were five cases of acute postoperative octeomyelitis treated by the actinic ray—one of the leg, two of the femur, and one of the tibia and fibula, and one of the humerus. The actinic ray in these cases, we believe, merely acted as a stimulant to more rapid healing, though we cannot definitely say that its influence was particularly evident as we had but a few cases available for this treatment.

The one exception was that of a chronic osteomyelitis of the humerus, which after a slow but satisfactory healing left a small sinus which drained for over a year, and was attached firmly to the bone below. The usual efforts failed to heal this small sinus. After a period of actinic ray treatments the sinus closed and has remained so now for about eight months. This young lady now engages in all manner of exercise and athletics.

There are four burns, two of the leg and one of the forearm and hand. These were all third degree burns with deep ulcers and a heavy hard keloid scaring. The actinic ray, used with massage and passive motion, markedly softened the keloid

Figs. 3 and 4—A and B. Severe third degree burn of forearm and hand. Treatment with actinic ray and physiotherapy. Almost normal function and healthy soft scar tissue.

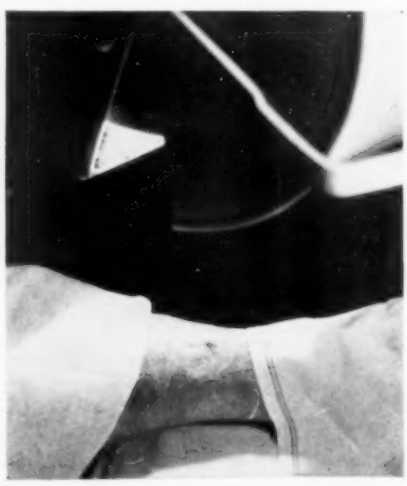

Fig. 5—Position of air cooled lamp treating varicose ulcer. Only small area of ulcer remaining to be healed. Generator 12 inches from patient, treatment five minutes.

formations. It caused rapid healing of the ulcers with unusual return of normal function.

The illustration (Figs. 3 and 4), shown is that of a right arm which was severely burned over almost the entire surface with a third degree burn. The patient came under our care two months after the burn with a large ventral ulcer and a perfectly stiff arm and hand. He could not flex or extend the wrist, or move the fingers. At the present time he has full supination pronation of the forearm. The fingers can now grasp a broom handle and he has full flexion of the elbow. The wrist has over fifty degrees normal movement, and he is steadily improving under this treatment.

Eight open wounds have been treated with a fair degree of success. One varicose ulcer (Fig. 5), about two and one-half inches in diameter, which had been open for over two years and had not responded to the usual methods of treatment, is now healed after ten treatments of the actinic ray.

Heliotherapy was used for its general stimulative action in nine cases. The entire body being exposed to the ray daily, following of course the deep therapy lamp. Some of these cases we checked very carefully with laboratory findings, and in each case so checked, the hemoglobin and red cell count was markedly increased, and remained so up to the time we discharged the patient.

X-Rays and X-Ray Apparatus: An Elementary Course*

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SECONDARY X-RAYS.

111. We may introduce this important subject by referring to an interesting experiment performed by Friedrich and Kroenig. Readings of the intensity of a beam of x-rays were taken with a filter, (1) half way between the target of the tube and an ionization chamber, (2) directly in front of the ionization chamber. Conditions in the two cases were otherwise identical. In the case of a copper filter 1 mm. in thickness, it was found that the intensity of the beam was 16 per cent greater when the filter was in the second position. What is the explanation? It may perhaps best be given by reference to another experiment.

Suppose an electroscope is completely shielded from a beam of x-rays emerging from a hole, S, Figure 96, cut in a sheet of lead so thick that normally no ionization is indicated by the instrument. Suppose, further, that a piece of any substance R, preferably of low density, such as a thin layer of aluminum, is placed in the path of the direct beam as shown in the illustration. It is then found that the presence of the aluminum causes an ionization current to be indicated by the electroscope. This is the case with the instrument anywhere near the aluminum, although always out of the path of the direct beam of x-rays. The explanation is found in the fact that when x-rays fall on matter (at least some kinds of matter), what are called *secondary x-rays* are emitted in all directions. In the experiment of Friedrich and Kroenig to which reference has been made, more of these secondary rays could enter the ionization chamber when the copper filter was immediately before it, than when at some distance away, hence the 16 per cent difference in the intensity of the beam as recorded by the measuring instrument. As secondary rays are of great practical importance to the radiologist, it is necessary now to consider this question somewhat in detail.

115. As the result of the work of many investigators, it is known that when x-rays pass through matter, a three-fold radiation may be emitted, (1) x-rays of the same type as the primary beam, known as *scattered rays*[1], (2) x-rays characteristic of the matter "excited" by the primary beam known as *characteristic "fluorescent" rays*, (3) an emission of electrons which is always associated with the beam of characteristic fluorescent rays, and is called a *corpuscular emission*. Secondary x-rays include the first two classes. Once again, useful analogies are found in the case of ordinary light. If there is much dust in a darkened room it is an easy matter to "see" a beam of light from an arc lantern. If a red glass is placed in front of the arc, the beam appears red because red light is reflected by the dust particles in all directions. Now the phenomenon of scattering of x-rays, while not exactly the same, is not unlike this scattering of light in all directions by dust particles. It consists in a re-emission in all directions of rays of the same kind as the primary beam.

Again, if certain substances are placed in the path of the beam from an arc light, or in direct sunlight, they are seen to fluoresce with a brilliant and characteristic color. Uranium glass, for example, emits a brilliant greenish light in this way; a solution of sulphate of quinine in sulphuric acid shows a characteristic and beautiful blue, and so on for many other substances. This fluorescent light, therefore, is characteristic of the substance and is caused by the excitation of the primary beam of light falling on it. Characteristic fluorescent x-rays are closely analogous. They are characteristic of the substance and result from its stimulation by a primary beam.

Even the corpuscular emission is an example of what is known as a photo-electric emission of electrons, which takes place when light falls on substances. If, for example, ultraviolet light is allowed to fall on a zinc plate joined to a negatively charged electroscope, it is found that the electroscope soon loses its charge. The stimulus of the light causes an emission of electrons from the zinc plate. So, in x-radiation, when a beam falls on matter, there may be an emission of electrons which, however, is always accompanied by the characteristic fluorescent radiation.

We shall next look at some of the laws relating to secondary rays, and then pass on to consider their importance in radiology.

Scattered Rays

116. (1) As already noted, these are of the same quality as the primary beam. (2) Scattering takes place in all directions about the radiator but the intensity has its maximum value in the same direction as the primary beam. (3) Scattering is most pronounced with substances of low atomic weight and therefore is of great importance in human tissue which contains such an excess of light elements. (4) "With the cop-

*Received for publication Dec. 27, 1923.

per group of elements, the scattered radiation is so small in amount that it is, for most purposes, negligible." (Kaye.)

Characteristic Fluorescent Rays

(1) These are identical with the characteristic rays which have already been discussed (Sections 107, 108). The difference between secondary characteristic or fluorescent rays and those leaving the target of a tube lies solely in their mode of generation. Fluorescent rays are generated as a result, not of the impact of electrons on a target, but of the stimulus of an exciting, primary beam of x-rays. X-rays may excite x-rays when falling on matter.

(2) To excite fluorescent rays the primary beam must in general be harder, that is, of shorter mean wave-length. On the other hand, the quality of the characteristic beam depends solely on the material of which the radiator is composed.

(3) The intensity of the fluorescent beam is the same in all directions about the radiator.

(4) "Characteristic radiations from materials of very low or very high atomic weight are either very soft or absent altogether: and so carbon, paraffin wax, aluminum, lead and metals of the platinum group are ordinarily to be preferred to metals of the chromium-zinc group, which possess pronounced characteristic radiations." (Kaye).

It should be evident, therefore, that the radiologist is chiefly interested in scattered x-rays, the effects of which may be almost as important as those of the primary beam. Two outstanding examples of their importance will be discussed, one relating to radiography, the other to deep therapy.

Scattered Rays and Radiography

117. The aim of the radiographer is to obtain a shadow picture showing good contrast and definition. That scattered rays may, in some cases, lessen the sharpness of the picture to such an extent as to make it of little use should be evident from an inspection of Figure 97. In this illustration, a, b and c represent the shadows of three small obstacles, A, B and C, on a photographic plate or film. If scattered rays were of no importance and the focal spot at F were fairly small, such shadows would ordinarily be sharp and the plate would show marked differences in density between the regions a, b and c and their surroundings (Section 113). Suppose, however, the objects A, B and C are surrounded by other particles of matter (as indicated by the small dots), which scatter x-rays in all directions. In that case sharp shadows would only be possible when the objects A, B, C were placed *near* the plate or film, somewhat as illustrated in Figure 98. If the objects are not near the film, sharp shadows will no longer be possible, for two reasons. In the first place, the scattered rays from each particle (such as 1 and 2), will cast their own shadows, and for each particle the shadow due to this cause, will occupy a different position. Again, scattered rays from many of the particles can pass under the objects and in this way affect the photographic plate in the region which the object shields from primary rays. For these reasons a good radiograph under such conditions would be impossible. Now, whenever an operator wishes to make a radiograph of a thick portion of the body, he is up against this difficulty. Certain parts cannot be brought near the plate and scattering of x-rays makes it impossible to obtain good results. Can the difficulty be overcome in any way?

There are two ways in which the desired improvement in contrast may be obtained, (1) by diaphragming, (2) by the use of the Potter-Bucky Diaphragm.

Diaphragms and Secondary Rays

118. Diaphragming consists in limiting the aperture of the primary beam to the smallest possible extent. In Figure 99, for example, AB represents a diaphragm which limits the area of the beam on the plate to MN, whereas had a diaphragm been used of the size indicated by the dotted lines the area would have been limited to CD. If, now, it is possible to diaphragm sufficiently when radiographing a thick body, considerable improvement in the contrast can be obtained. This may best be shown by giving some experimental results of Wilsey, of the Eastman Kodak Co., who has made an extended study of the effects of scattered rays in radiography.[2]

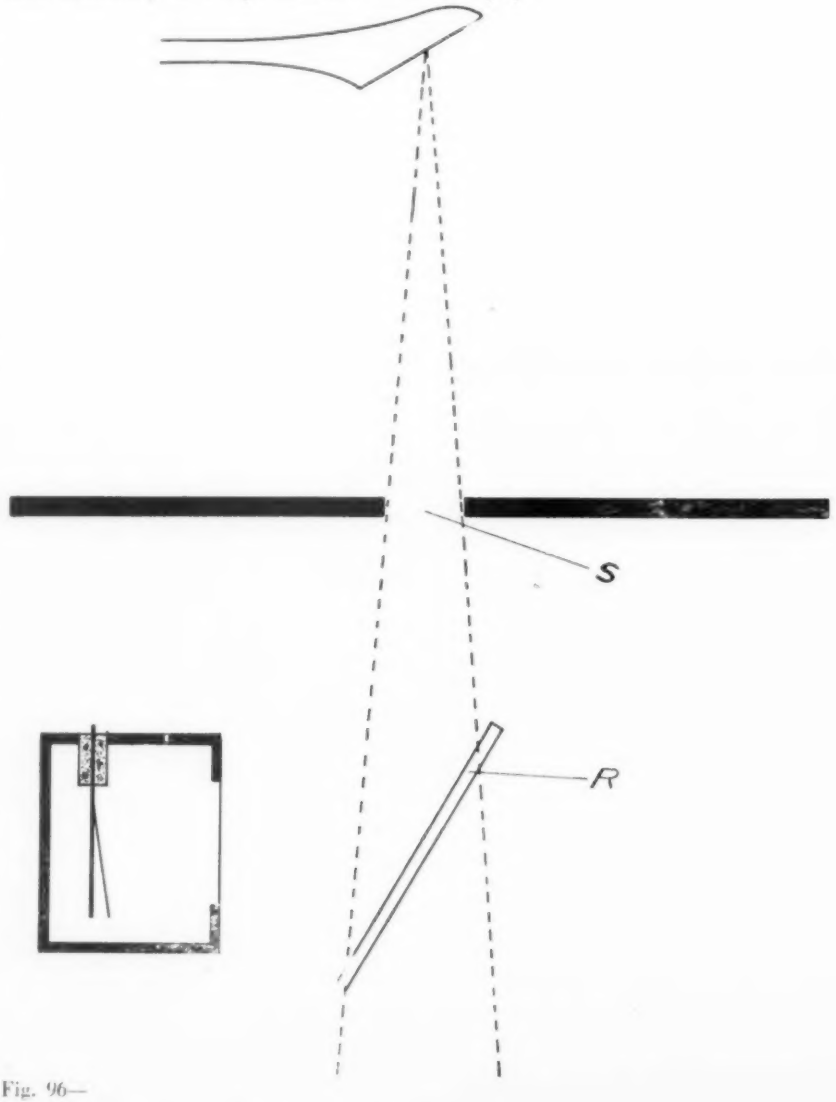

Fig. 96—

Wilsey by a simple experimental arrangement was able to compare the photographic intensity of the primary or focal beam with that of the scattered.[3] Using an aperture which gave a picture on the plate 20 inches in diameter, and a layer of water 6 inches thick as the scattering material, he found scattered radiation to be 4.9 times that of the focal beam.

By diaphragming until the picture was 8 inches in diameter scattered radiation was reduced to 1 times the focal, while if the picture were made 4 inches in diameter, the ratio was reduced to 2. In other words, if one could conveniently use a picture 4 inches in diameter, the effect of scattered rays would be cut down considerably, but with a scattering layer 6 inches thick, the effect of scattered rays is still twice that of the direct rays from the focal spot. While some improvement, therefore, is obtained by cutting down the aperture of the beam, the method is limited in its application and at the best not very efficient.

119. In the Potter Bucky Diaphragm, however, the radiographer is supplied with an arrangement which very considerably reduces the effect of scattered rays when thick portions of the body are being photographed. The underlying principle, as first suggested by Bucky, is simple. Suppose (Fig. 100), a grid of lead strips, separated by narrow slots, is placed between the object to be radiographed and the photographic plate. If the lead strips are placed so that they lie lengthwise along a curve somewhat as shown in the figure, it should be evident that the only rays which can get through the slots and so strike the photo plate are those in the direction of the focal beam. Secondary rays in other directions are cut off by the lead strips, as is clearly shown in the figure in the case of a few rays from particles 1, 2 and 3. Sharp shadows of objects such as A and B, therefore, would be cast. With a stationary grid of the kind described, however, such radiographs would be of little use, because the shadows of the lead strips themselves would be superimposed on the picture.

In the Potter-Bucky Diaphragm, this difficulty is overcome by adopting the simple device suggested by Dr. Potter, of keeping the grid in steady motion throughout an exposure. By this means, since each portion of the plate is covered for the same length of time, by each lead strip, the effect of grid shadows is eliminated. With such an arrangement, excellent radiographs may be made of the thick portions of the body. The grid moves along a curved track and is thus always in a position to allow the passage of primary rays, while immediately above the grid a thin curved sheet of metal supports the patient. Details of the mechanism controlling its movement will be found in the original papers.[4]

120. The device is so useful and important that certain further points should be noted. (1) The grid is equally efficient over the whole area covered. With a flat plate, however, the efficiency at the edges is not as high as at the center, where the plate is much closer to the grid. This difficulty may be obviated by using a curved cassette for holding a film with all parts close to the grid, an idea originally due to Van Allen[5].

(2) The time of exposure is considerably increased, some four or five times. This should be evident when it is remembered that with a 6 inch layer of scattering material and a large aperture, the intensity of scattered radiation is nearly five times that of the focal beam. As almost all of the scattered radiation is removed, it is the focal radiation alone which is affecting the photographic film, and increased exposures are therefore necessary.

(3) The effectiveness of the diaphragm depends not on the actual depth of the slots, but on the ratio of their width to their depth. To give an actual example from Wilsey's measurements, if the slot width equals one-fifth slot depth, from 85 to 90 per cent of scattered radiation is removed, with a 6 inch layer of water as scattering material. If the slot width is reduced to one-tenth slot depth, the efficiency increases to 93 per cent.

(4) For reasons already noted, this diaphragm is of use only when thick portions of the body are being radiographed, and even then its efficiency is not high unless the distance from patient to film is kept very small. "When the distance between material and film was as large as *one inch*, the smallest slit ratio tried (about 1/22), failed to give as good definition as was obtained without the use of any diaphragm. . . . The problem in grid design, then, is to make the grid as thin and fine-meshed as possible." (Wilsey). As Wilsey has made an extended investigation regarding the most suitable dimensions, it may be of interest to readers to give some of his actual results in connection with a highly efficient grid. "The slit depth is 0.16 of an inch, the slit width 0.05 of an inch, making the slit ratio practically one-third. The lead strips are 0.010 of an inch thick; the filling material consists of strips of celluloid. The whole grid is supported in a substantial frame with a curved aluminum floor 0.02 of an inch thick. The top cover of the diaphragm cover is of aluminum one thirty-second of an inch thick and the top of the curved cassette is of the same thickness. With such dimensions it was found that "when the diaphragm cover was supporting a weight or was under compression the distance between it and the film was about five-sixteenths of an inch."

Before the effect of scattered rays in deep therapy can be considered it is necessary to discuss the whole question of treatment and dosage. In the next chapter a detailed consideration of this important question will be given.

Dosage

121. For the intelligent use of a beam of x-rays for any purpose, two things must be known. (1) its quality. (2) its intensity. In preceding chapters we have sought to show how the quality of x-rays may be accurately and universally defined by giving the constituent wave-lengths or the effective wave-length of the beam. So far, however, nothing has been said about the *intensity* of radiation. The distinction between the two quantities, while simple, is so important that it is worth while noting an optical illustration. Suppose a red glass is held in the path of light emerging from a projection lantern and falling on a screen. If the light inside the lantern is made brighter (as can readily be done in the case of an electric arc by increasing the current), the red spot also becomes brighter. The light falling on the screen is still red, that is, its quality is unchanged but its intensity has been increased.

Again in sound, a tuning fork may be struck very lightly so that it is difficult to hear the emitted note, or it may be struck violently and heard at a considerable distance. In both cases the quality of the emitted note is the same; in the latter case, however, the intensity is greatly increased.

So, in x-rays we might operate a Coolidge tube always at constant voltage, but in one case with low milliamperage, in the second case, high. The effective wave-lengths in the two cases would differ but little; in the second case, however, the intensity would be greater than in the former.

Now, in radiography, and in treatment especially, an exact knowledge

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of the intensity as well as of the quality is necessary. In radiography, after rays of proper penetration (wave-length), have been chosen, the time of exposure must be adjusted to suit the intensity of the beam. In treatment, the correct "dose" is only possible when the intensity of the beam is known. It is highly important, therefore, to have means of comparing the intensities of two beams, and of ascertaining how the intensity of a beam varies with the conditions of excitation.

122. Before discussing direct means of measuring the intensity of a beam, we may note a few preliminary points. First of all, let us define exactly what is meant by the term. It is agreed to measure the intensity of a beam of x-rays at a given region (just like light radiation), by the quantity of radiant energy which each second passes through an area of one square centimeter placed at right angles to the direction of the beam at the region in question. In Figure 101, for example, the intensity at P is measured by the radiant energy which each second traverses an area of 1 square cm. (represented by the circle), placed at right angles to the line joining P to F, the focal spot.

(1) From this definition it should not be difficult to see that the intensity of a beam falls off with increasing distance according to the inverse square law. In other words, at double the distance from the source, the intensity becomes not one-half but one-quarter, $(\frac{1}{2})^2$; at three times the distance, the intensity becomes one-ninth $(\frac{1}{3})^2$. The reason should be clear from a glance at Figure 102. Suppose ABCD is an area 1 cm. by 1 cm. at a certain distance from F, the focal spot of a disdfbe, while A′B′C′D′ is exactly twice as far away. Since the lengths A′B′ and C′D′ will each be twice the lengths of AB and CD, the *area* A′B′C′D′ will be 2 by 2 or 4 sq. cm. It follows that the same amount of energy each second passes through A′B′C′D′ or 4 sq. cm. as passes through ABCD or 1 sq. cm. In other words, double the distance, the intensity is reduced to one-quarter, or, in general, the intensity falls off inversely as the square of the distance. This law has been amply confirmed by direct experiment.

(2) For general x-rays (Sec. 103), it has been shown that the intensity of the beam increases: (a) with the current through the tube: double the milliamperage, the intensity is doubled; (b) with the voltage across the tube: double the voltage, the intensity is increased *fourfold*; (c) the atomic number of the target: the higher N the greater the intensity. Putting these laws in symbols, we may write, the intensity of a beam of general x-ray is proportional to $N\,i\,V^2$, where i=tube current, N=atomic number, and V=potential difference between the two sides of the tube.

In general, therefore, an operator with a certain outfit (the same tube and the same transformer), has a right to assume (if he is using general x-rays, which at high voltages would be largely the case), that if he doubles his tube current, the in-

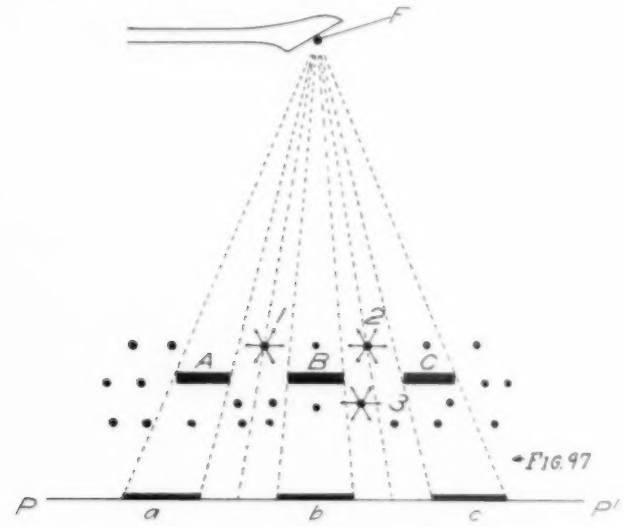

FIG. 97

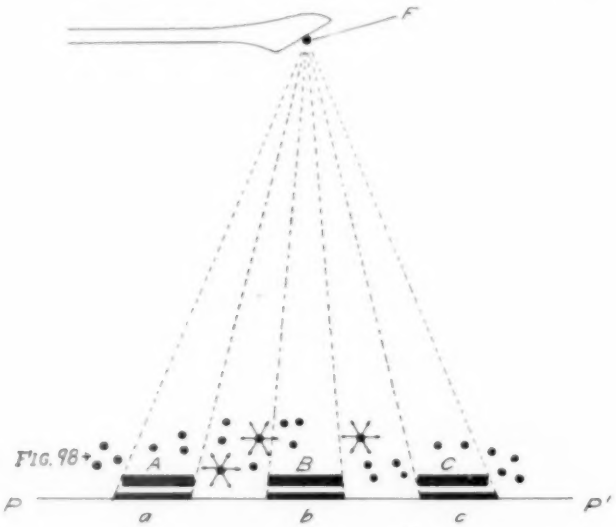

FIG. 98

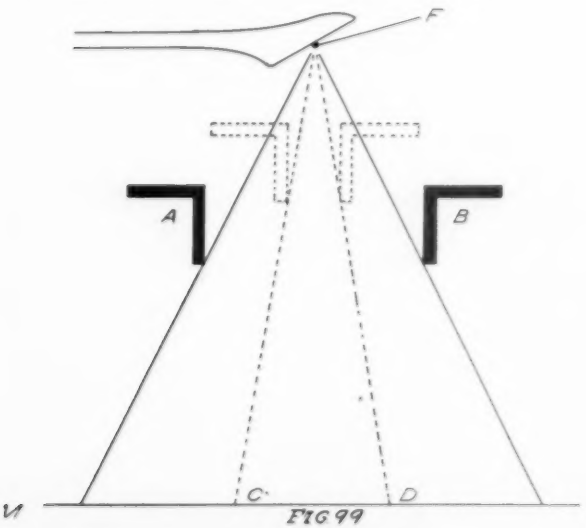

FIG. 99

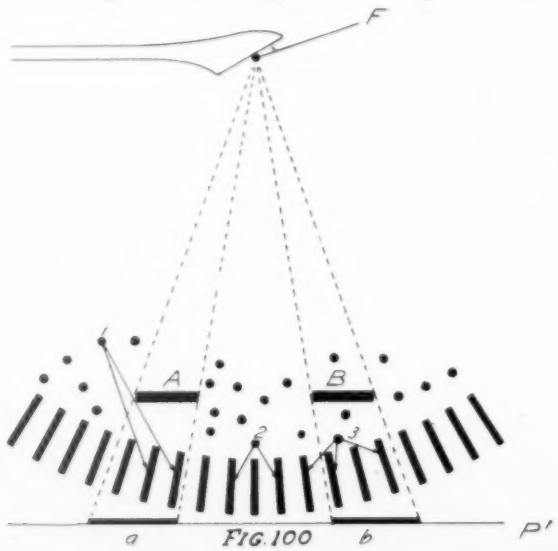

FIG. 100

tensity at any point is doubled; if, however, he doubles the tube voltage, the intensity is increased *fourfold*. Moreover, if he keeps current and voltage constant and changes the target distance, he knows that the intensity falls off according to the inverse square law.

123. In treatment, therefore, it is possible for a radialogist to alter the intensity of radiation in a way which he may calculate from observed readings of tube current, tube voltage, and target distances. Provided such measurements are accurately made, useful work can be done by using such a method. But, while such readings are desirable and give useful information, they are not sufficient. Sometimes filters are used, sometimes not: the filter may be changed: sometimes it is a surface area which is being treated, sometimes a region below the skin. How is an operator to know the change in intensity brought about by such changes in the conditions? Scattering of rays, moreover, profoundly affects the dose when treating deep-seated tissue. Again it is highly important that one radiologist be able to compare his results with those of another working with a different tube and a different outfit. It is necessary, therefore, to have some simple *direct* means of measuring radiant energy.

This brings us to the all important question of dosage and here again it is necessary that we clearly define exactly what we mean by an applied dose of x-rays. A beam of x-rays passes through the area or region to be treated and a certain amount of energy is absorbed. Certain biological changes take place and if the dose has been effective, a cure results. Now just what it is brings about the desired biological changes, is not exactly known. Such changes may be directly proportional to the amount of ionization in the tissue resulting from the absorption of x-rays, or they may be proportional to the absorbed energy which brings about the emission of corpuscles. Something is to be said for each of these assumptions, while both may be wrong. In any case, because of our lack of knowledge of exactly what is responsible for the biological changes, it is not possible to state what is the *absolute* dose. It *is* possible, however, to make use of certain properties of x-rays and so to establish practical and universal means of measuring the physical dose applied. By such means an invesigator may co-relate his work from day to day, as well as compare his results with other workers.

125. Since x-rays have different properties, several such physical means of measuring dosage may be and have been used. We shall first briefly note the most important of these and then discuss the various methods somewhat in detail.

(1) *Photographic*: In this method, as exemplified by the Kienboeck strip, the dose is measured in terms of the amount of silver deposited from the emulsion on sensitized paper, or, in other words, by the degree of blackening resulting from the absorption of the rays.

(2) *Chemical*: In this method the dose is measured in terms of the amount of iodine liberated from a solution of iodoform in chloroform.

(3) *Pastille*: Under this heading we place the methods of Sabouraud and Noire, Holzknecht and Hampson, in all of which the dose is measured in terms of the change in color in certain salts resulting from the absorption of rays.

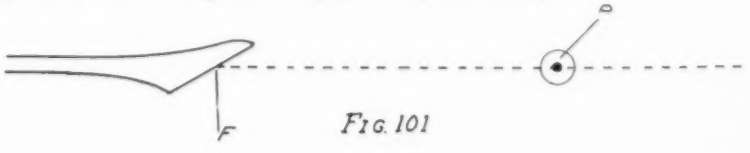

FIG. 101

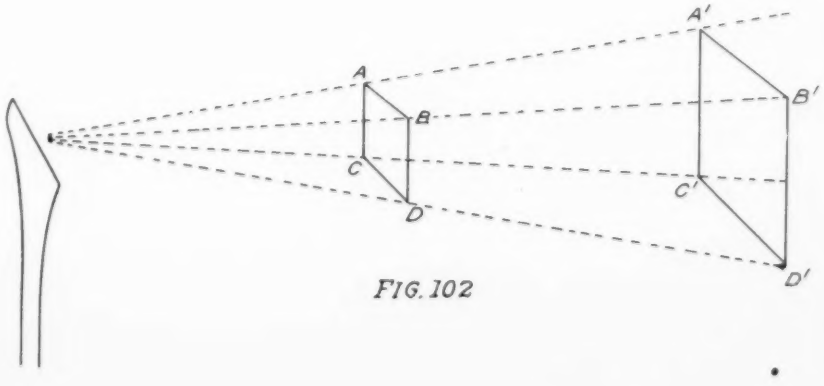

FIG. 102

(4) *Electrical*: When light waves or x-rays fall on the substance selenium its electrical resistance alters. In the Fuerstenau intensimeter we have an instrument in which dosage is measured by making use of this property.

(5) *Ionization*: By the use of ionization chambers, or iontoquantimeters the dose may be measured in terms of the ionization produced in a medium such as air.

126. Now, whatever the means adopted, there must be some standard, some unit, in terms of which dosage may be applied. In medicine, so many grains, so many spoonsful are prescribed; what about x-rays? Obviously the unit adopted will vary with the property of x-rays utilized. In the photographic method, for example, it will have to bear some relation to the degree of blackening of the sensitive paper: in the chemical method, to the amount of iodine liberated. In all cases, however, the unit adopted, if at all satisfactory, should satisfy certain conditions. (1) It should be convenient, easily measured, reproducible, and should not vary from day to day. (2) It should be of such a nature that fractions or multiples of it may be used. (3) It should be applied to the whole range of wave-lengths used in radiology. (4) Since in treatment we are concerned with the absorption of rays by tissue and since the biological effect probably bears some direct relation to such absorption, the absorption of the substance used for measuring purposes should vary with the wave-length in a manner similar to the variation exhibited by tissue. Putting it in another way, condition (4) means that the ratio of the absorption by say 1 cm. of tissue to that of 1 cm. of the test substance should be the same no matter what wave-length is used. (5) Finally, some idea of the "size" of the physical unit should be known in terms of its biological effect. Ten of the particular units adopted might either kill or cure! Moreover, the methods and consequently the units used by two men may be of quite different "sizes." Ten of one man's unit might be ineffective, while ten of another might be a bad overdose.

127. To consider the last point first, the difficulty is overcome by giving the size of all physical units in terms of what is called the Erythema Skin Dose (the E. S. D., or U. S. D.). When x-rays are absorbed by the skin in sufficient quantities, an erythema results. Here, then, is a definite simple biological effect to which all physical units may be related. It is necessary, of course, to

define exactly what is meant by the E. S. D. Unfortunately, partly because of differences in human beings, partly because of its biological nature, this cannot be done as exactly as we define, say a meter. According to Seitz and Wintz, the E. S. D. "gives rise, after about five days, to a slight hyperemia which gradually subsides, leaving the skin undamaged though pigmented or tanned." (Morton). In another reference[6], the unit is defined as "that quantity of rays which causes a slight reddening of the skin after fourteen days." Probably there is little difference in these two.

Whatever the physical unit adopted, therefore, *by actual experiment*, its relations to the U. S. D. may be found. What this relation is will be given below when we examine some of the practical units which have been utilized in x-ray dosimetry. Before doing so, it is well to note that the physical dose will depend both on the *intensity* of the beam and *the time* of application (although it does not necessarily follow that a high intensity for a short time has the same effect as a feeble intensity for a long time). For this reason physical means of estimating dosage may be divided into two classes, (1) those in which a direct measure of the *intensity* of the beam at any moment, is combined with the time, (2) those in which the integrated effect of the beam for the whole time of application is obtained. The difference will be clearer from the specific examples which we shall now discuss.

The Kienboeck Strip

E. S. D.=10 X.

128. In this method the degree of blackening produced in sensitive photographic paper by a dose of rays which gives rise to an erythema is arbitrarily called 10x. Lesser degrees of blackening correspond to subdivisions of the standard dose, and so units ½x, 1x, 2x, 3x, 4x, 5x, 7x, are also used. In actual practice the sensitive paper is placed on the skin of a patient, and a standard scale is supplied giving the shades corresponding to the standard and sub-doses.

This method is, therefore, simple and convenient but does not lend itself to a high degree of accuracy. Moreover, it does not satisfy the fourth condition noted in Section 126. That this is so is evident from measurements made by Friedrich and Kroenig, to some of which we have already had occasion to make reference. In Section 82, it was pointed out that these investigators have shown that for rays of different penetrations, water absorbs within one or two per cent to the same extent as tissue, and consequently might with little error be used as a phantom for tissue. In order, therefore, to compare the absorption of the Kienboeck strip with tissue for a whole range of wavelengths, Kroenig and Friedrich made a set of measurements on the relative absorption of water and of silver, the latter being one of the chief absorbing constituents of a photographic emulsion. Their results showed that "quite marked differences exist in the ratio of the amount of absorption in water and in silver with the different qualities of rays." To give an example, for unfiltered rays, the ratio obtained was 0.93, for much harder rays (filtered through 1 mm. of copper), the ratio was 0.51. This, then, is a decided objection to the use of the Kienboeck strip for accurate work.

The Sabouraud and Noire Pastille

E. S. D.=Tint B.

129. Until recently the pastille method has been used to a considerable extent by radiologists. As an example of its use, we may deal with that of Sabouraud and Noire. A salt of barium platino-cyanide in the form of a round pastille some 8 mm. in diameter is exposed to the rays, the pastille, in actual use, being placed on a metallic sheet at a distance from the target equal to one-half the distance from target to the patient. In this position the standard dose changes its color from the original pale green to a brownish yellow, called Tint B.

Other dosage "measurers" on the same principle which have been used are (1) Holzknecht's Quantimeter, E. S. D.=5H; (2) Bordier's Chromo-Radiometer, E. S. D.=Tint 1; (3) Hampson's Radiometer, E. S. D.=4H.

In all of these, dosage is measured in terms of a change in shade, the standard dose in some cases being subdivided by the use of different tints. To assist in the observations "tintometers" may be used.

The use of pastilles, however, although convenient, cannot be recommended for exact work. By way of objection we cannot do better than quote Colwell and Russ[7]. "A simple experiment may show the misleading indications of these pastilles. A pastille is placed in the usual position and exposed to the rays from a very soft bulb, and the time noted to change its color to the standard tint; the bulb is then hardened and the current in the primary adjusted, so that a new pastille placed in position suffers the same color change in the same time. The dose, as measured by these two pastilles, is the same yet the clinical effects upon the tissues are profoundly different in the two cases."

This is in line with the later quantitative work of Friedrich and Kroenig, who showed that there are marked differences in the ratio of the absorption of water (and so of tissue), to that of platinum (the metal of the pastille salt), when the effective wave-length is altered. In other words, pastilles do not satisfy the fourth condition noted above.

Chemical Method

130. In this method the unit as suggested by Bordier[8] is the quantity of x-rays which is able to free 1/10 of a milligram of iodine from 1 c. c. of a 2 per cent solution of iodoform in chloroform, having a thickness of 1 cm. and protected from light. The writer is not in a position to give the relation of this unit to the erythema dose.

The Fuerstenau Intensimeter

131. In all of the above methods, dosage is measured directly, that is, the effect observed depends on the integrated effect of both intensity and time. In the Fuerstenau intensimeter we have an example of a device which measures the *intensity* of the beam. As already noted, the method depends on the fact that the change in the resistance of selenium depends on the x-ray energy absorbed per second. Unfortunately the writer has not been able to find in the literature at his disposal the unit adopted.

132. The method of measuring dosage which is proving most satisfactory is based on the ionization produced in air when traversed by a beam of x-rays. In the next article this important method will be discussed in detail.

Footnotes

1. There is some experimental evidence that scattered rays may be slightly softer than the primary beam.

2. Wilsey, R. B.: Jour. Frank. Inst. 194:593, 1922. Am. J. Roentgenol. 9:58, January, 1922; 9:141, July, 1922; 8:328, June, 1921; 8:589, October, 1921.

3. Under "scattered" is also included the radiation which might be present due to rays originating at places other than the focal spot.

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Cancer of the Tongue Under the Influence of Radium, Electrocoagulation and X-Ray*

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Foreword

WHEN the patient of about 40 years of age is sufficiently alarmed to come to the well trained physician upon the advent of the very first persistent sore on the tongue, (a sore that has lasted for more than two weeks), then a different story will be written. It will be a bright story, and not the sad and painful story we read today. But as long as the patient waits until there is a distinct lesion, and worse yet, gland metastases, we will continue to read tragic pages.

In a man between 40 and 60 years of age, a sore on the tongue that fails to heal within a few days should be viewed with alarm, and no time should be lost in establishing a definite diagnosis. Bloodgood[1] states that he has evidence to show that men who develop cancer of the tongue have been warned by definite local lesions.

I am such a believer in the intelligence of the people of the United States that I feel that if the propaganda against cancer is continued agressively with the public, the time will come when it will be rare to see an advanced case of cancer of the tongue, except among the totally illiterate. This time can be hastened by the individual instruction of each patient by the family physician. It is my hope that the caustic stick and silver nitrate will be relegated to oblivion. I have seen too many cases that have been fanned into active malignancy by the injudicious use of these agents. Bainbridge[2] in "The Cancer Problem," asserts that unless the escharotic can destroy every vestige of the lesion it is worse than useless. Much valuable time has been lost by these temporizing methods.

Etiology

We read that tobacco, either smoking or chewing, is the prime etiological factor in cancer of the tongue. Personally, I have been able to trace the tobacco habit as the cause in but a very small percentage of tongue cancers. The majority of cases can be traced to faulty teeth, jagged snags, bad crowns and ill-fitting plates. Again, a syphilitic gumma may be the forerunner of carcinoma, not because it is a luetic sore, but because of its chronicity. There must, of course, be existing a predisposition to cancer. The sore that spells havoc in the individual with this predisposition is no more than a troublesome irritation in person without this predisposition.

Abbe[3] holds strongly for tobacco as the etiological factor, claiming that 90 per cent of cancers of the tongue originate from tobacco and only 10 per cent from jagged teeth.

Leukoplakia that has existed for a long time is a distinct causative factor. In the south, snuff chewers are particularly liable to cancer of the tongue and cheek.

Location

In my own work I find that the initial lesion is more frequently found on the side of the tongue where the latter organ comes in contact with the molars. Next, in point of frequency, comes the base of the tongue on one side or the other. The under surface of the anterior portion comes third. The floor of the mouth is the site of cancer in a small percentage of cases. I have never seen a cancer in the middle of the tongue. A few cases have come under my observation where the cancer involved the base of the tongue and tonsil. These cases were all advanced when they came to my notice, and both tonsil and tongue seemed equally involved. Therefore, it was impossible to determine which was the primary lesion.

Glands Affected

The lymphatic drainage of the anterior and the base of the tongue is separate and distinct. When the initial lesion is in the base of the tongue, the deep cervical glands are the first to show metastases. But when the lesion is on the side of the tongue the submaxilliary gland is the first to show involvement. The superior cervical glands are involved when the anterior portion or tip of the tongue shows the initial lesion.

There is a collar of lymphatics which acts as a wall around the neck and metastases beyond this collar is not seen. Unless the initial lesion is very far advanced it will usually heal under the administration of radium, leaving the gland involvement for our worry.

Treatment

Only a few years back it was the custom in all tongue cancers to slice off a good section and if the involvement was great, the patient submitted to the Kocher operation. Besides this, unilateral and sometimes bilateral block dissections of the neck glands were done. The cautery was used at the time of these operations. After radium came to the front the operations continued, but the surgeon, realizing that the knife alone was not doing all he could desire for the patient, used radium at the site of the operation, and noticed that recurrences were not so frequent. Finally, in some of our leading hospitals, the initial lesion is not attacked by the knife, but all dependence is placed upon radium, thereby escaping the mortality rate following surgery. And it is a question whether the block dissections of invaded glands have done all that was hoped for. There have been cases where the procedure seemed to cause a spreading to the other glands along the chain.

While tongue cancer even in its early stages is a grave condition, yet I feel perfectly safe in saying that since we have learned to imbed radium in the substance of the growth, as well as the periphery, our end-results are more satisfactory than when surgery was used alone. While in some cases we believe in a combination of surgery and radium in the glands of the neck, experience prompts us to use radium alone in the tongue.

*Read before the Mississippi Valley Medical Association, Hot Springs, Ark., Oct. 10, 1923.

Quick[4] reports 148 cases of cancer of the tongue treated during the three and one-half years prior to the report. There were 134 cases in men and 14 in women. Of these, 69 cases were primary growths without nodes. Of the 148 cases, 58 neck dissections were done (39 per cent), supplemented with radiation with heavy filtered radium. Of these 58 cases, 15 cases recurred. Of the entire series, 43 cases or 29 per cent are clinically free from cancer. When we take into consideration that only 27 per cent were operable, the percentage of clinical cures speaks well for the radium treatment of cancer. The fact that the mortality following radium is nil, while the mortality following the knife is from 10 to 30 per cent, places the former in the front rank of cancer combative agents.

Judd and New[5] take the stand that radium should not be used in the early stages of tongue cancer, when the case is operable. Time will tell whether radium is superior to the knife in the early stages of all tongue cancers. I am confident that it is the equal of surgery now, and in many instances superior, principally because of the absence of the mortality element when radium is used.

Radium element in needles or radium emanation in small capillaries is equally efficacious. The latter perhaps possesses some advantages because of the smallness of the capillaries. Our aim in the treatment of the tongue lesion is to imbed the needles or the capillaries throughout the invaded area and also beyond it, using a dose destructive to all cancer cells.

We know that when a total dosage of 2,000 milligram-hours is given in one side of the tongue at one session, it is of sufficient strength to have a lethal action on any embryonic cells on the other side of the tongue. This then is the reason why radium is superior to the knife, because of its penetrating power into territory where the surgeon would not dare go.

The dosage required varies with the individual case. In an early case where the ulceration has not started, from 600 to 1,000 milligram hours will be sufficient. When there is ulceration and induration, as much as 2,000 to 2,500 milligram hours may be used. Several needles should be employed, that the rays may be equally distributed. The reaction from radium is painful and is accompanied by swelling of the tongue, and when using the larger dose the parts of the oral cavity adjacent to the radiated portion of the tongue are affected. After heavy radiation I have observed in all cases a swelling of the submental and submaxillary glands. But this gradually subsides. The patient must be warned before the treatment that the tongue and mouth will be much more sore for a week or so than ever before. Otherwise, they will be panic stricken when the inflammation commences about seven days after the treatment. I have found that orthoform applied to the inflamed area, lessens the pain to some extent. In favorable cases the reaction will be over in a month, and the lesion healed and induration gone in another two weeks. In the more persistent cases further applications may be necessary, but I am coming to the belief that it is the first dose that must do the work. Therefore, it is necessary to have this dose sufficiently large even at the risk of some unnecessary anatomical destruction (Hanford[6]).

The mouth must be kept clean by the frequent use of alkaline mouth washes. There will be considerable sloughing in advanced cases, but after the slough has separated the severity of the pain is less. When the slough bothers the patient, I use powdered caroid, which is a vegetable digestive ferment. This can be dusted over the surface once or twice a week. If used oftener it causes discomfort.

We will meet with cases more or less frequently where after the reaction from the radium has subsided, complete healing does not take place. There may be just one little spot that has not healed and in a month, six months, or a year we will notice the first signs of a breaking down at the site of the old scar or in the immediate vicinity. In some of these cases I have found that radium is not indicated, as there seems to be a devitalized tissue existing and the application of radium increases the trouble rather than the opposite. In these cases the use of electric coagulation is of great value. That the treatment may be successful, it is necessary that the electrode points should be introduced into the tongue beyond the palpable margin of the diseased area. The introduction of the electrode should be one centimeter apart. The coagulation time for each introduction is five to seven seconds. This method will cause a separation of the diseased area from the healthy portion in the course of three weeks.

Prior to the treatment of the tongue with the radium needles, it is advisable to ligate the external carotid on the diseased side. When this

Fig. 1—Carcinoma of the tongue, preceded by a gumma. Metastasis in the left sub-maxillary gland. Needles were implanted, and a dose of 1,500 milligram hours given.

Fig. 2—Case shown in Figure 1, after treatment. Very little scar evident.

Fig. 3—Carcinoma of tongue, nearly healed after 1,450 milligram hours.

Fig. 4—Carcinoma of tongue, following a gumma. This was electrocoagulated but refused radium treatment.

Fig. 5—Tuberculosis of the tongue. This might be mistaken for cancer, except for the fact that cancer of the tongue never occurs in the middle of the organ.

is done there is less liklihood of hemmorhage. Especially is ligation desirable if electric coagulation is employed as there is great danger of bleeding when the slough separates.

Treatment of the Glands of the Neck

Quick[7] reviewed 516 lip cases reported by Broders where neck dissections were performed in 448 cases or 87 per cent. Not a single patient with involvement of more than one group of lymphatics recovered.

It is Quick's opinion that epidermoid carinoma in the cervical nodes cannot be destroyed by external radiation alone, and, therefore, in all cases with operable nodes on admission or those which develop nodes after the treatment of the primary lesion with radium, a neck dissection is performed. This is done after the maximum inflammatory reaction from the treatment of the primary growth has subsided. After removal of the lymphatic structure, radium is imbedded in the field.

Others do not favor neck dissections, but prefer massive x-ray dosage over the entire chain of lymphatics. For radiation of the submaxillary, submental and upper cervical glands when not palpable, I use radium packs, giving each position from 2,000 to 3,000 milligram hours. The radium is elevated two and two and one-half centimeters from the skin. If the glands are distinctly palpable, it is my practice to imbed radium needles. In the submaxillary gland, for example, I employ 1,500 milligram hours. I have noted that this dosage prevents extension in the gland treated, but has very little if any effect on more distant glands, therefore, thorough work necessitates needles in all palpable glands. When we are careful and conscientious in our treatment, I feel that our end-results are as good as when the nodes are surgically removed. Especially so in cases where the mass has perforated the gland capsule.

Fig. 6—Showing radium needles partly imbedded in a cancer of the tongue. These are entirely embedded in the tissue.

Summary

1. The primary lesion should not be excised, but should be destroyed by imbedding radium needles in the periphery of the lesion. If, however, excision is decided on, a prophylactic dose of radium should be employed soon after the operation.

2. Palpable glands that exist at the time of treatment of the primary lesion or appear soon after, should be removed surgically, after which radium should be placed in the field of operation.

3. If the glands are not palpable, x-ray or radium packs, should be applied over the submaxillary, submental and the entire chain of the cervical lymphatic system.

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EDITORIAL

The JOURNAL OF RADIOLOGY

A Journal of Ideas and Ideals.

Published monthly at Omaha, Nebraska, by the Radiological Publishing Company for the Radiological Society of North America.

Subscriptions—In the United States, its possessions and Mexico, $5.00 yearly; Canada, $5.50; elsewhere, $6.50 the year.

Advertising rates on application. All advertising must conform to American Medical Association Rules.

Payments for subscriptions and advertising must be made to Radiological Publishing Co., in New York or Chicago Exchange.

Address all communnications to Business Office, 121 South Thirty-third Street, Omaha, Nebraska.

The Economics of Radiology.*

THE PRESENT economic situation of the radiologist in America is represented by a saggital section of the stream of American life. To analyze this cross section with all the various eddies entering into it is a task which few of us can successfully perform. Even though one may make a fairly accurate analysis today, tomorrow it will be obsolete. The stream of life flows constantly forward. Here one sees rapids, there the whirlpool, yonder the deep still water and at the side the shallow stagnant pool in which the smaller organisms flourish. The main current, however, is constantly toward the sea.

The Anglo-Saxon word "economics" has its origin from two Greek words, which literally mean "the art of household management." As used today, "economics includes the discussion of all the numerous factors which make life profitable, whether to the nation or to the business or to the individual man."[1]

A study of the economics of the radiologist would necessarily include all the factors which might have an influence upon the profitable pursuit of his chosen profession.

Since the radiologist is admittedly a member of the greater medical profession, certain influences come from that source. On the other hand, the economic problem of the medical profession is merely part of a cross section of the general economic problem. Due to the changed conditions produced by and following the World War, much is being written regarding the general economic state. This introspection permeates all walks of life, including the medical profession as a whole and the radiological profession in particular.

It seems that the various factors of the economic problem of the radiologist fall into two natural groups: (1). Those from without the individual which affect the special profession as a whole and (2) those within the individual member of the profession—the man himself. Let us first consider some of the factors coming from without which influence the specialty of radiology. America is a young country with vast territory and thinly distributed population so that up to the present decade the practice of medicine has been largely of an individualistic character. The physician was licensed or even practiced without a license, chose his own location and carried on his work as he saw fit. This plan of operation allowed the great majority to carry on general practice as represented by the family physician. A certain small percentage, however, located in the more densely populated districts and set themselves up as specialists. No authority greater than the individual himself determined the qualifications of the specialist. This led to a period of over-specialization, the era from which we are just now emerging.

(1) Encyclopedia Brittanica.

Surgery: The rapid advance of bacteriology which followed the invention of the microscope paved the way for rapid forward strides in surgery. The surgeon received large fees for services performed in a relatively short time which in turn attracted many men to the specialty. As more men entered the practice of surgery, more thought was given to the finesse of the work itself, resulting ultimately in the knowledge that greater care in diagnosis was imperative if the patients' interests were to be conserved. Since surgery could command good fees and possessed a great pyschological influence on the layman the surgeon became the executive, calling in the internist, the pathologist, the bacteriologist, the serologist and the radiologist to help make the diagnosis before surgery was attempted or in some cases even to treat cases which were not amenable to surgery. This evolutionary process was the forerunner of present day cooperative medical practice.

Medicine: The rapid development of the medical specialties, bacteriology, pathology, radiology, serology and physiological chemistry so broadened the field that the internist, single handed, found it impossible to carry on all of these lines of work to the best advantage. He in turn, became the executive directing a corp of specialists in the various branches of medicine. The change in surgery and in medicine then resulted in the modern system of

Group Practice: Here then appeared to be the ideal method where medicine and surgery and all the various ramifications of the two could be housed under the same roof and work in the closest cooperation. As the independent specialties had grown up the cost to the patient gradually increased until, from the patients' viewpoint it became almost prohibitive. Facing this situation the group, with its centralized authority, could so arrange the system of charges made to the patient that they would be mutually satisfactory. That is the patient could have the advantage of any and all kinds of examinations that would help to solve his problem and at a moderate charge. Recent advances in the charge made for diagnosis in various "clinics" shows the above scheme has not proved profitable as predicted.

Standardization of Hospitals: Along with the developments mentioned above came a better understanding of the relationship of the medical profession to the lay public. In order to correct certain undesirable practices the cooperation of the hospitals of the country was sought. This movement resulted in the agreement of a large number of hospitals together with the members of the various staffs of these hospitals to follow certain rules of conduct. Among these may be mentioned: 1. No fee splitting. 2. Efficient record system. 3. Pathological department

in charge of a trained pathologist. 4. X-ray department in charge of a medical radiologist. 5. Regular staff meetings. It is readily realized that this system of cooperation really makes each hospital a working group. The patients have the advantage of a thorough examination at a minimum cost, the attending physician acting as the executive in each case. This gives each member of the staff the advantage of group practice without losing control of the patient.

Better Knowledge: Concurrent with the changes mentioned above came a better knowledge of the general practitioner. This knowledge concerned all the specialties of medicine including surgery and radiology. The live man in general practice must have a working knowledge of all phases of medicine. He secures this knowledge by frequent short courses of postgraduate work in which he studies one thing intensely for a few weeks then goes back and applies his knowledge, then in a few months takes up another subject. There are many men practicing medicine in outlying communities who are as well trained in medicine as the best in the cities. The reason then for patients who live in a community served by such a physician going to some other medical center for service is a phychological one rather than a lack of good care at home.

Hospitals in smaller communities: The man in general practice has paid the price of good training and broad clinical experience so that he is now capable of caring for all of his patients, arriving at a working diagnosis and administering the necessary treatment. In order to serve his patients better and for his own protection, small hospitals have been established in practically every community. The establishment of these community hospitals has had a tremendous influence upon the practice of medicine and surgery as well as the specialty of radiology in the large centers. For example, only a few years ago the general surgeons were very busy operating upon acute appendicitis cases which had come in from the country districts. Now they seldom see such a case. The acute cases are operated at home in the small hospital by the family physician. Only the difficult surgical cases are referred to the city surgeon.

Simplified X-Ray Equipment: We are living in a mechanical age the influence of which permeates all walks of life and has had much to do with the present economic situation in radiology. While the changes mentioned above were taking place, certain mechanical and electrical improvements were being made in x-ray apparatus which greatly simplified the equipment necessary for diagnostic work. Indeed, so simple has the equipment become that the power plant operates from the ordinary light current found in the office, the operation of which is as simple as turning the current on and off. This change enabled the manufacturers to reduce the cost of equipment to such an extent that the man in the smaller community could put in apparatus to care for his fractures and all ordinary diagnostic cases. That naturally reduces the number of such cases referred to the city specialist but at the same time better knowledge of the value of radiology by the general practitioner leads him to refer more of the difficult cases.

Technicians: The simplification and standardization of x-ray equipment made it possible to train the office assistant to do the routine mechanical part of the work. In fact, an intelligent graduate nurse who has mechanical aptitude can be trained in a few months to do the routine work of x-ray exposures. With proper supervision she will turn out better average work than most physicians attempting to do the same kind of work. This is due to the fact that the routine work is her particular task and is to her an end in itself, while the physician does it only as a means to an end.

The employment of technicians leaves the physician free to devote his time to the study of anatomy, pathology and clinical medicine which are the foundation stones upon which correct interpretation of x-ray films rests. Instead of the technician taking work away from the physician she enables him to do his work better. The radiological technician has come to stay just as the trained nurse has come to stay. She has a distinct niche to fill in radiological economics and the sooner the medical men in the profession gain a clear cut idea of the limitations of this niche the better off we all will be. The technician's duty is to produce the best photographic results in a given case while the radiologist must not only have knowledge of the mechanical phases of the work in order to properly supervise them, but he must also have a broad knowledge of anatomy, pathology and medicine in order to give correct interpretations. On no other fondation can the radiologist expect to ascend to the rank of consultant.

Commercial X-Ray Laboratories. By a commercial laboratory is generally understood a place where x-ray examinations are made at a fixed charge of so much per film or so much per patient, the charge being suited to the character of the examination. Of the commercial x-ray laboratory two types are found, the one manned by a physician or dentist and the other by the lay technician, the former type may be good or evil, depending entirely upon the character of the man in charge. He is licensed by the state to practice medicine or dentistry and has the right to conduct his x-ray laboratory in the manner he sees fit. The chief objection here is to those men who have the false idea that by cutting prices they serve the profession and the public better. This usually leads to a point where the price is reduced to such an extent that the work is unprofitable, so that the more volume secured the worse off is the institution. In this manner the undesirable man eliminates himself.

Commercial x-ray laboratories operated by lay technicians have no excuse for existence so far as I can see. They are nothing more than "picture galleries" where "pictures" are made at so much per "picture." The patient does not get a real service and the physician or dentist referring patients to such a place is helping to maintain a festering sore in our commonwealth. In New York City, the Department of Public Health has secured the passing of a city ordinance which provides for licensing all commercial laboratories. By the method of examination the laymen can be eliminated. Other cities are contemplating a similar method of meeting this economic situation.

Fee Splitting: The secret division of fees has been a widespread practice in American surgery. It led to certain abuses which in turn caused the American College of Surgeons and the American Medical Association to take a stand against it. In some states the practice has been made a statutory offense. It seems almost impossible that this practice should enter into radiology where the average fees are so much smaller and the cost of doing business so much greater than in surgery. If any radiologists are guilty of this custom the same principles apply here as in surgery.

Cutting Fees: The cost of doing business is greater in radiology than in any other branch of medicine. Where the surgeon has two or three rooms in his office, with one nurse and possibly one poorly paid assistant, the radiologist must have many rooms, several nurses and assistants and thousands of dollars invested in

equipment, the depreciation on which runs about twenty-five per cent. The hospital carries the major portion of the surgeon's overhead expense while the radiologist must carry his himself.

With these facts in mind, it will be seen that the radiologist must know his cost of doing business. In estimating charges he must add to his cost a reasonable profit if he expects to continue in business. To cut fees below this point is suicidal. He who disregards this principle of conduct will soon eliminate himself so why should the other members of the profession worry?

Let us turn now to a consideration of those economic factors originating within the individual himself for the individual radiologist is the unit from which radiology s built.

Personal Life: The individual habits of the radiologist have much to do with his economic situation. If he is frugal, living within his income, he is happy and inclined to spend his thoughts upon constructive effort in his work. Where he lives beyond his income his thoughts are directed away from his work, he becomes unhappy, and, seeing his fellow radiologists succeed better than he is doing, becomes jealous of their success and a chronic fault finder.

Professional Life: The radiologist who wishes to succeed is industrious. Union hours have no meaning to him when there is work to be done. He is industrious physically and mentally. His mental energy is directed toward gaining a thorough knowledge of anatomy, pathology, clinical medicine and special knowledge relating to radiology. The radiologist keeps an anatomy and a pathology easy of access at all times and uses them until the pages are worn. He never lets an opportunity pass to attend postmortem examinations, for accurate knowledge of anatomy and pathology are the foundation stones upon which the superstructure of radiology is built. "For other foundation can no man lay . . . . "

Radiology touches every phase of medicine so that the radiologist cannot know too much about clinical medicine. In no other way can he rise to the position of consultant. The easy way, of course, is to be the "picture taker" where one need not overtax his brain with such burdensome material as a knowledge of anatomy, pathology and medicine.

The successful radiologist puts forth the efforts necessary to master all technical knowledge of his specialty so that his films may show the highest photographic quality and his positions and technique may reveal the information most helpful in arriving at a diagnosis. The successful radiologist makes frequent visits to other radiologists, internists and surgeons so that he may gain the other man's viewpoint as well as acquire additional knowledge. Frequent courses of postgraduate study are not only helpful but necessary for success. At all times anatomy and pathology are first, with technique second in importance.

In all these phases sound judgment is constantly exercised so that the radiologist does not go off on some tangent and thus cast discredit upon radiology as a whole. The radiologist's work comes to him largely through the influence of other physicians so that he develops the greatest ability in handling the referring physician as well as the patient. He inspires confidence in both and at the same time "delivers the goods."

As pointed out in a preceding paragraph the radiologist is confronted with heavy investment and heavy overhead expense. If he is to succeed under these circumstances he must develop sound business acumen and must rigidly follow the rules necessary in his particular case.

This discussion is far reaching but it contains what appears to me to be the essential factors influencing the radiologist at the present time. The spirit of the radiologist is so beautifully described in the poem by William Wadsworth entitled, *"Character of the Happy Warrior,"* that I feel constrained to quote it:

"Who is the happy Warrior? Who is he
That every man in arms should wish to be?
—It is the generous Spirit, who, when brought
Among the tasks of real life, hath wrought
Upon the plan that pleased his boyish thought:
Whose high endeavors are an inward light
That makes the path before him always bright:
Who, with a natural instinct to discern
What knowledge can perform, is diligent to learn
Who, doomed to go in company with Pain,
And Fear, and Bloodshed, miserable train,
Turns his necessity to glorious gain;
'Tis he whose law is reason; who depends
Upon that law as on the best of friends;
He labours good on good to fix, and owes
To virtue every triumph that he knows:
—Who, if he rises to station of command,
Rises by open means; and there will stand
On honourable terms, or else retire,
And in himself possess his own desire;
Who comprehends his trust, and to the same
Keeps faithful with a singleness of aim,
—He who, though thus endued as with a sense
And faculty for storm and turbulence,
Is yet a Soul whose master-bias leans
To homefelt pleasures and to gentle scenes."

* Read by request before the Omaha Roentgen Ray Society January 21, 1924.

Iowa Radiological and Physiotherapy Meeting.

The Iowa Radiological and Physiotherapy Society announces a meeting to be held at Des Moines, February 26, 27, 28 and 29. The officers of this society are W. A. Johnston, M. D., President, Dubuque; A. L. Yocom, M. D., Vice-President, Chariton, B. H. Sherman, M. D., Secretary, Dexter. An excellent program is being arranged. All are cordially invited.

New York Medical Journal.

Under the title, "Medical Journal Progress" an editorial in the Medical Journal and Record announces that the old New York Journal and Medical Record has outgrown any purely local function and hence has taken unto itself the new name of "The Medical Journal and Record" as a more suitable title for a journal national and international in its field of influence.

New features are a department of historical medicine and a supplement. Each issue of the supplement will be devoted to some special field of medicine and will give the newest findings in that field and will present a symposium of value to both general practitioner and specialist. The journal will also contain original communications coming from the entire field of medicine. Dr. Gregory Stragnell is the editor.

ABSTRACTS and REVIEWS

The Anatomic Basis for Interpreting Roentgenograms in Rickets. A. A. WEECH, M. D., and M. S. SMITH. Am. J. Dis. Child. 26:117-131, August 1923.

THE only element to constantly cast a shadow in the roentgenography of rachitic bone seems to be calcium in the form in which it naturally occurs in bone. Decalcified tissue leaves a record only through negative shadows. Therefore with sufficient anatomic knowledge the actual histological alterations can be predicted from the plates.

Exophthalmic Goiter in Children with Some Unusual Manifestations. HENRY HEIMAN, M. D., Am. J. Dis. Child. 26:216-222. September 1923.

THIS condition is rarely found in children but it is sometimes found. In children under ten years of age the Mayo Clinic reported an incidence of 0.3 per cent among 1,512 cases of all ages; Klein reported 5 per cent of 3,177 cases; Barret believes from his extensive studies that the proportion of cases in children to those in adults is 1 to 50.

The author recommends physical and psychical rest and if this does not produce results he would give roentgen ray treatment and if this should fail would resort to thyroidectomy. He would not delay this too long, however.

A Preliminary Report of the Action of Buried Radium on Diseased Thyroids in Man. J. O. BOWER, M. D., F. A. C. S. and J. H. CLARK, M. D., Am. J. Roentgenol. 10:875-880, November 1923.

RECURRENT carcinoma of the thyroid, simple colloid goiter complicated by carcinoma of the larynx, and a typical toxic goiter are here reported as having been treated by radium. Large doses of buried radium were employed, were well borne and gave no untoward symptoms and results were worth while. The authors conclude thus: "The use of buried radium is a feasible therapeutic measure and gives reliable results. We believe that radium is far superior to the injection of boiling water, quinine and urea or polar ligation; that it is indicated in cases that are poor operative risks. Owing to the apparent resistance of thyroid tissue to radium rays, as found from experimental work, it is urged that those using radium in thyroid diseases employ comparatively large doses of buried element."

Irradiation of the Thymus in Myasthenia Gravis. HUGO MELLA, M. D., Med. Clinic. N. A. 7:939-949, November 1923.

FROM a review of the literature and from his experience with two cases here reported the author believes there are cases of myasthenia gravis in which abnormalities of the thymus may be found. His study also suggests to him that this is a syndrome and not a disease entity as cases have been reported in which no abnormality of the thymus was discovered. The myasthenic syndrome may follow on tumor of the thymus and disappear upon irradiation of the thymic region.

Neoplasms of the Mediastinum in Infants and Children. WILLIAM ROSENSON, M. D., Am. J. Dis. Child. 26:110-117, November 1923.

NEW growths of the mediastinum are rare in children but they do occur and this fact should be kept in mind in the differential diagnosis of obscure intrathoracic conditions. The author reports one case occurring in a child of eight years.

Reviewing the literature he found 38 cases cited, of these 15 were sarcomas, 9 carcinomas, 6 dermoid cysts, 4 lymphadenomas, 1 a lipoma, 1 a ganglioneuroma and 2 of unknown origin.

Radiographic Observations on Children Constipated Since Birth. I. H. GOLDBERG, M. D., Arch. Ped. 40:374-380, June 1923.

NO SURGEON would attempt to set a fracture without resource to the x-rays and it is equally foolish, the author believes, to attempt to treat a case of chronic constipation of unknown etiology without such aid. A proper appreciation of the anatomy and physiology of the gastro-intestinal tract is necessary before intelligent treatment can be instituted. One should know the region of the bowel in which the stasis occurs and must also know whether the case is of congenital or acquired type. If it is congenital in type then anatomical peculiarities may account for the constipation, e. g., an elongated or a redundant colon, a dilated cecum, pyloric obstruction, pylorospasm, kinks, etc. The hepatic and splenic flexures fixed by mesenteric attachments often form very acute angles and the transverse colon being long permits of ptosis, sacculations and double and triple tranverse colons. Dislocation of the cecum due to its having no mesentery is another frequent cause of chronic constipation. Acquired causes may be atonic, spastic or obstructive.

Fifteen children under seven years of age coming to the author because of chronic constipation were examined radiographically and the radioscopic study has opened up an entirely new field in the management of these cases. Findings are given in these cases and treatment for similar cases is advised.

The Value of Ventriculography. FRANCIS C. GRANT, M. D., Arch. Neurol & Psychiat. 10:154-166, August 1923.

IN FIFTEEN out of forty cases localization by the ventriculogram was exact and in eight other cases the localization, while unconfirmed, seems probably correct. In four cases the findings were misleading owing to errors in technique. In three cases the possibility of tumor was excluded and in three other cases it was not possible to demonstrate the air on the roentgenogram. There was a mortality of 12 per cent.

In the author's clinic at the University Hospital, Philadelphia, the ventriculogram is not regarded as infallible, and neurologic findings are not disregarded even if they run counter to the ventriculogram. Not every case should have an air injection performed, especially if the neurologic findings give positive evidence as to the area of brain involved, but obscure cases or those in which operation has not revealed a cortical growth, but where the presence of a tumor is certain, make a ventriculogram necessary.

Cerebral Glioma with Early Pressure Manifestations Upon the Optic Chiasm. G. ARTHUR LARSON, M. D., Journal-Lancet, 43:621-623, December 1923.

EVERY patient who has visual disturbance associated with systemic symptoms should have a thorough opthalmologic and roentgenologic examination associated with thorough study of the visual fields. Cerebral glioma, however, presents no definite clinical picture. It should be considered in the differential diagnosis if there is any question of neoplasm producing pressure upon the optic chiasm.

Calcification in Brain Tumors. R. R. NEWELL M. D., Surg. Clin. N. A. 3:775-785, June 1923.

THE AUTHOR says that the importance of visibility in the roentgenogram due to calcification has been underestimated as a diagnostic and localizing sign in brain tumor and that modern advances in x-ray technique have resulted in an important increase in the number of calcifications shown. Gliomata, he says, are not infrequently calcified and he reports three proved cases. He claims that about one-half of the adult population has calcification of the pineal gland.

The literature upon this subject is briefly reveiwed and the data on 227 head cases from the author's clinic at Leland Stanford Hospital are presented.

Cerebral Pneumography as an Aid in the Early Diagnosis of Hydrocephaly. OWALD S. WYATT, M. D. Journal-Lancet 43:625-628, December 1923.

THIS METHOD is a most valuable aid in the diagnosis of intracranial conditions and definitely differentiates hydrocephalus into two types, namely, obstructive internal hydrocephalus and communicating internal hydrocephalus. In the former it definitely localizes the lesion and is a guide to surgical intervention. Cerebral pneumography is a great step forward in neurological surgery.

A Clinical Study of Radium Therapy in Carcinoma of the Rectum. HOWARD A. KELLEY, M. D., F. A. C. S. and GRANT E. WARD, M. D., Surg. Gynec. Obst. 37:626-634, November 1923.

THE FOLLOWING paragraphs give the authors' conclusions:

"Radium used alone or with some operative procedure is par excellence our most valuable therapeutic agent in the treatment of cancer of the rectum in all stages. Its therapeutic value lies both in its palliation and its high percentage of cures—11 per cent of those treated. As a palliative measure it benefited 62 per cent of all the cases. In the hopeless group radium is valuable in giving relief to various symptoms and affording comfort for the remainder of life. There are a number (27 per cent of the whole) who did not respond and these we term for the present as not 'radio-sensitive.' In this group the tumor was fixed in 40 per cent, and practically all were well advanced. The one way to determine the radiosensitiveness of a tumor is a substantial treatment followed by careful observation; in other words, the great benefits to be expected from radium justify its trial in every case of cancer of the rectum.

"As to the best method of radium application sufficient data are not at hand at present to draw positive conclusions. We feel that we must give the implantation of needle points a fuller trial as we believe that it alone, or it combined with other methods, will yield the highest percentage of improvement and of cures. At present we can say that uniformly, whether by radium alone or in combination with operation and colostomy, a combination of external and internal application gives the highest percentage of palliation, while the radical operation plus external treatment yields the highest percentage of well patients, namely 32 per cent, and external treatment in cases where there was no operation gave a cure of 11.1 per cent.

"Briefly, the procedure in treating a case of carcinoma of the rectum as indicated by our results would be: (1) If the case is operable, radiate and operate, there being little choice which should be done first, but especially radiate externally. If all the growth cannot be removed, either treat internally as well as externally or implant bare glass needle points if sufficient growth remains after the operation. This can be done at the operation. (2) If the patient is inoperable, or a border-line case, treat heavily with external and internal radiation and implant in the hope of bringing the tumor to an operable size or causing it to disappear entirely. If it becomes operable, operate and radiate again if necessary. If there is postoperative recurrence, radium offers excellent palliation and a good chance of cure. Of all the well cases, 9.9 per cent were recurrent after previous operations. (3) If on admission there is obstruction, a colostomy should be done; however from our statistics it does not seem wise to do a colostomy as a routine or even as an expedient measure unless there is obstruction.

"Finally, in this series radium therapy has been helpful in obtaining 11 per cent cure and a 62.5 per cent palliation of all cases in the series of 200 suffering from carcinoma of the rectum treated in our hospital."

Diathermy for Malignant Disease of the Mouth, Pharynx and Nose. NORMAN PATTERSON, M. B., Ch. B., Brit. M. J. 2:56-57, July 14, 1923.

SEVENTEEN sucessful cases are reported. The author has been using diathermy in these conditions for more than eight years and the great majority of his cases were in an advanced state of disease. He has experienced no difficulty with severe hemorrhage in any case since he adopted the plan of ligating the main vessel supplying the part to be treated, when extensive treatment is to be given or when the patient has thickened arteries or high blood pressure.

If the primary growth is extensive, deeply rooted and in a locality unfavorable to its destruction, and especially if the secondary deposits in the neck are massive or fixed there is small likelihood of cure. An ulcer or an indurated area in the mouth or pharynx of a patient over middle age is more likely to be malignant than otherwise. Septic ulcer, cyst or gumma is often given as the diagnosis when the real trouble is epithelioma. It should be remembered that buccal or pharyngeal cancer will often give a positive Wassermann. If the glands cannot be dealt with it is of little use to apply diathermy to the primary growth except for palliation. If the area treated approaches or invades the fascial planes of the neck then there should be an interval of two or three weeks between destruction of the primary growth by diathermy and the neck operation, otherwise fatal sepsis may occur. If the surgeon is in doubt whether he can make a thorough clearance from the neck then the gland operation should precede that upon the primary growth.

Two Cases Illustrating the Benefit of Light Baths in Tuberculous Disease of the Skin. J. H. SEQUEIRA, M. D., Proc. Roy. Soc. Med., Sect. Dermat. 16:63, May 1923.

THE AUTHOR reports very beneficial results from the exposure of two cases of lupus to rays from a strong arc lamp, as is done in the Finsen Light Institute. The patients sit, stripped, around the light which is fixed three feet from the floor.

Back and front of the body are alternately exposed. The carbon arc light is considered better than the mercury vapor or tungsten lamp.

Heliotherapy in Psoriasis. HARRY E. ALDERSON, M. D., Arch. Dermat. and Syph., 8:79-81, July, 1923.

THE AUTHOR has found heliotherapy a more successful agent in the treatment of psoriasis than roentgenotherapy. Recurrences are longer delayed after ultraviolet treatment than after roentgenotherapy and there is no danger of producing alopecia.

Radium Therapy of Vascular Nevi. HOWARD MORROW, M. D. *and* LAURENCE R. TAUSSIG, M. D., Am. J. Roentgenol. 10:867-871, November, 1923.

THE authors' experience with radium therapy of vascular nevi has shown it to be a superior agent to carbon dioxide snow or any other known agent. Radium therapy is most satisfactory, they say, in treating nevus vasculosus, next to cavernous angioma and least satisfactory for nevus flammeus. The beta rays should be used as much as possible and severe reactions are not justifiable.

How a Physiotherapy Department Pays. E. S. GILMORE, Superintendent, Wesley Memorial Hospital, Chicago. Hospital Management 16:45-46, September, 1923.

THE author says: "Those who are p r e j u d i c e d against every 'opathy,' not their own, saw in this (physiotherapy), an encroachment of osteopathy, and it were immeasurably better to die in an orthodox manner than to be cured of anything savoring of heterodoxy." But the war settled one thing, at least, and that is that physiotherapy has come to stay.

Physiotherapy is most effective when all forms are used, including hydrotherapy. As an aid in treatment of injuries and a tonic to internal organs and for the treatment of misused muscles physicians are finding physiotherapy of great value. The success of the physiotherapy department will depend upon thorough conscientious work. Each patient must have individual treatment adapted to his needs. Manual manipulation can do some things that physiotherapy cannot do and a proper combination of both is recommended. "Parlors" or "studios" may do very excellent work at times but diversified medical and surgical skill is requisite for maximum results. If a hospital has its own physiotherapy department treatment can be begun much earlier in hospital cases than if they had to be sent to some outside laboratory and besides a physiotherapy department will prove to be an educative influence in the community. It will attract the same people who now patronize the commercial offices and in the hospital department they will learn much of which they were ignorant.

Even a small hospital can afford the necessary apparatus. The following is a suggested equipment: (a) A high frequency machine for autocondensation and for diathermy. (b) A portable combistat giving galvanic and sinusoidal currents in their various forms. (c) A portable Bristow coil giving a modified Faradic current. (d) A high candle power lamp giving ultraviolet rays. (e) Massage tables, stall board, pully weights and a table with various appliances for exercising the hands. These can be made by the hospital carpenter with supervision of the work by a surgeon.

A hydrotherapy room is desirable but it runs into much more money than the above as it must have an electric light cabinet bath, a shower and needle spray with its control table. Much of the cost will depend upon the amount of plumbing found necessary.

No patient should be turned away because of insufficient funds. The substantial benefits derived by patients will attract a sufficiently large paying clientele to make the department a source of revenue to the hospital.

It must be remembered that apparatus is not all that is needed. Brains are vital to success. The department may begin with only one man but he should be highly trained and skilled, else harm will result in many cases.

Physiotherapy. F. B. GRANGER, M. D., Med. Clin. N. A. 7:1019-1031, November, 1923.

PHYSIOTHERAPY came into recognition during the war when it was used as an adjunct to all other branches of medicine and surgery. In the United States the Surgeon-General defined physiotherapy as "Physical measures such as are employed under the term physiotherapy, and mechanotherapy, active exercises, indoor and outdoor games, and passive exercises in the form of massages. Civil hospitals, insurance companies and large employers of labor were stimulated to establish a department of physiotherapy. Boston City hospital, long before the war, had such a department in full operation.

Peripheral facial paralysis, stiff and painful shoulders, delayed or non-union of bone and hypertrophic arthritis are conditions and lesions for which treatment is described in this paper.

In peripheral facial paralysis the sooner treatment is begun the better. Under stiff and painful shoulders the author discusses bursitis, arthritis, muscle tear or stretch and adhesions. The technique of treatment is described. In delayed or nonunion of bone, diathermy is of value if proper fixation can be secured, the rationale is the use of heat as a cell proliferator. In hypertrophic arthritis relief from pain and stiffness may be obtained even though x-ray findings remain unchanged.

Physiotherapy with Especial Reference to Diathermy. L. R. GANNET, M. D., Med. Woman's Jour. 30:355-358, Dec. 1923.

PHYSIOTHERAPY came into its own during the late war under the leadership of such men as Frank Granger of Boston, Charles Sampson of Stapleton, Staten Island, William Benham Snow and William Seaman Bainbridge of New York.

Electrocoagulation should be used only by the expert surgeon. Dessication and fulguration are excellent for the removal of warts, for carbuncles and polypi but time and scrupulous cleanliness in the after care are necessary factors in securing results.

In cases of Bell's palsy the static wave current applied by means of a sheet metal electrode cut to fit snugly each side of the ear and over the submaxillary space is the most efficient treatment. Such a case is cited in which the thermolite used for thirty minutes and followed by the ultraviolet for four minutes at a distance of 36 inches for two days in succession was followed by the electrode with a very short spark gap for ten minutes on the second day until the time was gradually increased to twenty minutes. After the third or fourth treatment the pain ceased and after twelve treatments the patient was cured and has remained so for three months to date.

Deafness and tinnitus aurium are often helped by the static brush discharge and it is beneficial in cases of sprain and bruise. Patients should not be given too long a treatment the first time but a treatment of less than 20 minutes duration will be disappointing in its results. Likewise if the machine is not kept clean.

light, dry, well aired and well oiled, results will not be good.

For successful treatment a high frequency outfit producing from 1,000 to 4,000 ma. is necessary, with insulated rheophores and sheet metal for making electrodes.

The effect desired and the skin tolerance of the individual patient will determine the strength of the current to use. Technique is given for application and treating the head, trunk, thigh and upper arm.

Diathermy may be made either sedative or stimulative and if improper technique is used the patient will get only a condenser discharge which will increase rather than diminish the pain. Diathermy is useful in all forms of arthritis and neuritis, bronchitis, pleurisy and pneumonia and in joints and muscles rigid from disuse. It is also an aid in treating catarrh of the gall-bladder. It is not, however, a cure-all and calls for knowledge in its use, e. g., if used in pressure of encapsulated pus the wall will break and metastatic abscess will result. Ultraviolet in rickets and anemia and as a protection against x-ray burns is recommended. For the latter purpose it is used immediately after x-ray treatment and every two or three days in between.

At the present time one of the great obstacles to progress in physiotherapy is the lack of any facilities for learning the principles and practice thereof.

Chronic Intestinal Stasis and Cancer. Sir Arbuthnot Lane, Consulting Surgeon, Guy's Hospital, London. Brit. M. J. 2:745-747, Oct., 1923.

THIS author believes that dietary habits are largely responsible for cancer incidence. He believes that chronic intestinal stasis leads to cancer and that a change in dietary habits would bring about a decreased cancer incidence.

Two Cases of Carcinoma of the Abdomen. William H. Robey, M. D., Med. Clin. N. A. 7:705-714, November, 1923.

ONE of the patients was a man aged 28 and the other a man aged 30. The reasons for making the report are the youth of the patients and the difficulties of diagnosis. One was a case of the mesenteric lymph glands and the other was carcinoma of the stomach.

Artificial Production of Cancer in the Lungs Following the Intrabronchial Insufflation of Coal Tar. Noriyoshi Kimura, M. D., Japan Med. World, 2:45-47, March, 1923.

BRIEF reference is made to the experimental work of Fibiger, Yamagiwa, Winteritz, Smith, Ibuka and Fischer with the concluding observation that in their work along this same line of research these men made observation merely on the simple proliferation of epithelia or on the production of an adenoma-like structure but that cancer was not produced. Hence the author's research, here described.

Three rabbits and ten gunica pigs were used and a small amount of crude coal-tar was forced into the bronchus of each animal by way of a tracheotomy wound after the animal had been compeltely anesthetized. One rabbit and three guinea pigs survived. The rabbit was killed on the eightieth day and the guinea pigs on the one hundred and fortieth day. In the lung of the rabbit was found a small adenomatous area and in one of the guinea pigs was found a multiple adenocarinoma of the lung.

Roentgenologic Studies of Pneumoconiosis and Other Fibrosing Conditions of the Lungs. H. K. Pancoast, M. D., Am. Clin. Med. 2:8-23, July, 1923.

THERE are *three definite sets of* shadows seen in the normal lungs. One set is composed of those of the hilum and they are distinctly visible on each side of the denser shadow of the heart and great muscles and are cast by the structural walls, vessels, lymphatics, etc. Radiating from this set of shadows are those cast by similar structures of the trunk and they are visible up to the outer third zone of the lung. The third set of shadows is made up of finer linear markings which gradually disappear toward the outer surface.

Accentuation of these normal shadows may be due to congestion due to a chronic respiratory infection or to a continual irritant, or it may be due to fibrosis following upon these conditions. Frequently the appearance of shadows is not characteristic of the disease present. Correlation of data, both clinical and roentgenological is necessary in arriving at conclusions. The fluoroscope is necessary in the study of lung fibrosis for the fibrosis has a tendency to restrict diaphragmatic movement and the more extensive it is and the nearer the lung is to the fibrosed area the greater is the interference.

Tuberculosis and pneumoconiosis are the two most frequent causes of lung fibrosis and the two have many points in common. The active agent of each is air borne and the effect is primarily on the lymphatic system, and in the second stage of each, evidence of the condition is indicated by changes in the lymphoid deposits in the lung parenchyma, although the part of the lung affected and the immediate effect upon the tissues begins to differ widely here. Hence there is a certain similarity in the roentgen appearance and both conditions may exist simultaneously. Dust fibrosis produces but few clinical phenomena except in advanced cases. Silica is the injurious constituent of dust and fibrosis is produced by it. The author suggests "silicosis" as a term to describe this particular form of fibrosis.

The asthma present in the sand storm regions may really be due to silicosis.

There are three stages in pneumoconiosis: (1) peribronchial and root thickening, (2) localized and parenchymal fibrosis, (3) diffuse fibrosis. The first stage cannot be distinguished from results of any acute or chronic respiratory condition although a coexisting adult tuberculosis can be distinguished from it. In the second stage the mottling is striking and characteristic and can be confused only with miliary tuberculosis. It almost always makes its first appearance on the right side, begins in the second zone around the root of the lung and gradually spreads although it is always most marked around the root. There is not usually any interference with costal expansion and diaphragmatic phenomena in this stage and detection of coexisting tuberculosis is almost impossible.

Intrathoracic Malignant Tumor Stimulating Tuberculosis. Report of Three Cases. J. S. Pritchard, M. D., Am. Rev. Tuberculosis, 8: 304-307, November, 1923.

FROM the cases reported the author concludes that "An afternoon fever up to 100 degrees and frank hemoptysis or blood streaked sputum are frequently found in both pulmonary tuberculosis and malignant tumor, especially in young adults. The physical signs in pulmonary malignant tumor are as a rule very indefinite as compared with the extent of the disease. Rales appear rather late. The x-ray gives the most help in the diagnosis of pulmonary malignant tumor, and in most instances gives the only evidence on which to base a diagnosis. The shadows are often very characteristic."

The Technique of Chest Roentgenography in Pulmonary Tuberculosis. L. T. BLACK, National Jewis Hospital for Consumptives, Denver. Am. Rev. Tuberculosis, 8: 371-382, Dec., 1923.

THE author's summary reads thus: "In a comparative study of roentgenopraghs, taken in the posterior-anterior position during suspended diaphragmatic inspiration and suspended costal inspiration, on 25 patients with pulmonary tuberculosis, there were found two cases of far advanced pulmonary tuberculosis in which the roentgenograph taken during suspended diaphragmatic inspiration revealed changes of a definite nature which were not revealed in the roentgenograph taken during suspended costal inspiration thus corroborating Bray's observations.

"In a series of 11 cases of pulmonary tuberculosis of which roentgenographs were taken in the posterior-anterior position and the anterior-posterior position during suspended diaphragmatic and suspended costal inspiration, there was found one case (far advanced pulmonary tuberculosis), in which the roentgenographic findings differed during suspended diaphragmatic and suspended costal inspiration. In spite of these findings, and as a result of a general survey of the situation, considering the diagnostic value of these differences and the economic side of the question it can hardly be recommended that for general diagnostic purposes in pulmonary tuberculosis more than one type of position and inspiration be used. The matter of choice for general use rests entirely with the individual case. For purely academic or research purposes, however, and to obtain the maximum detailed information on an individual case, it is recommended that at least both types of inspiration be used and, if possible, the two positions, posterior-anterior and anterior-posterior be taken."

Early Diagnosis of Pulmonary Tuberculosis by Roentgen Rays. Japan Med. World, 2:35-40, February, 1922.

THE author writes of the clinical observation, of the route of infection in pulmonary tuberculosis, of diffusion, whether foci in the hilus or in the apex be primary, the roentgenological sign of tuberculosis, the diagnostic value of roentgenology and presents a comparative study of percussion, auscultation and roentgen observation.

Of prognosis, he says it may be more easily arrived at by roentgen ray. This agency will show whether the actual stage of the pathological process is a catarrhal stage with only localized infiltration or whether it is a large infiltration in the deeper parts of the lung and also whether there is any consecutive involvement. If there is abundant sputum and no large infiltration of the lung, prognosis is fair. If heavy meshwork lines show then the affection is chiefly of the interstitial form but if numerous specky shadows show then the prognosis is not so favorable.

Rapidly Developing Pyloric Stenosis. HAROLD SWANBERG, M. D., Am. J. Roentgenol. 10:905-906, November, 1923.

A CASE is reported in which duration of symptoms was very short but consequent pathology was very marked. Clinical symptoms were such that malignancy was not suspected. The growth was found located in the pyloric ring, grew rapidly and produced a complete pyloric stenosis and the stomach dilated rapidly because of the obstruction, however the patient did not vomit. The author says that every patient past middle life with indefinite gastric symptoms not responding to the usual medical and dietetic treatment should have a roentgenological examination to determine whether malignancy is present.

Radiography of Closed Fallopian Tubes to Determine the Location of Obstructions. WILLIAM T. KENNEDY, M. A., M. B., Am. J. Obst. & Gynec. 6:19-32, July, 1923.

NO RADIOGRAM should be made in any case in which there is evidence of bleeding. If one knows the position of the uterus the degree of flexion of the body of the uterus can be determined. The internal os can withstand a pressure of 200 mm. of mercury in the cervical canal without its musculature allowing the passage of any solution into the uterine cavity. Many isthmii, while permitting the sodium bromide to pass through their canals can overcome a pressure of 200 mm. of mercury and expel their contents in either direction.

Of the tubes examined, 30.8 per cent were occluded at the isthmus and 69.2 at the fimbria. Of those tubes casting a shadow the isthmii appeared in 61.2 per cent and did not appear in 38.2 per cent.

If in a radiogram obtained according to the above method one or both tubes seem open or partially occluded it is likely that only one tube is open and in this case practically all of the sodium bromide would be seen in that side of the pelvis. When the cervix is tightly closed the uterus and tubes completely empty their fluid contents into the peritoneal cavity.

The surgeon can detemine the following points before he opens the abdomen: Length, breadth, position and direction of the canal of any tube casting a shadow; the exact site of the occlusion, whether at the fimbria or in the isthmus; whether a tube open at the isthmus and closed at the fimbria is empty and simply clubbed or filled with fluid such as hydro or hematosalpinx; also whether an operation to overcome the obstruction and thus remove the sterility might hopefully be done when at least one isthmus is open or whether it might be almost useless when both isthmii are closed.

The Limitations of Radiotherapy in the Management of Fibromyoma of the Uterus. JAMES ALBERT CORSCADEN, M. D., Am. J. Obst. & Gynec. 6:24-50, July, 1923.

IN THE treatment of myoma of the the uterus by radiotherapy selection of the case is of first importance. The responsibility for treating the case should not be divided but the radiologist should assume it. Extra-uterine neoplasms and malignant growths should first be excluded. Chronic adnexal inflammation so light as to escape diagnonis need not be a deterrent.

Symptoms of toxemia, anemia unexplained by loss of blood, local pain, tenderness, change in consistency of the tumor, rapid growth and large size may indicate inflammation, degenerating or sarcomatous change and may demand excision.

Of the symptoms associated with myoma, bleeding due to ulceration or blood vascular disease may not cease with the onset of the menopause but in the author's experience all others do. Pain associated with menstruation will cease with the onset of the menopause but all other pain may not. Urinary disturbances are not well relieved.

Shrinkage of the myoma will almost always follow adequate radium and x-ray treatment but the discomfort of such a dosage coupled with the danger connected with the raving of such a large mass make operation preferable.

Dosage insufficient to induce the menopause is unsatisfactory for the mass may fail to shrink and the effect on the hemorrhage is uncertain, the mental reaction on the patient is also bad. Hot flashes are constant

and slight increase in nervous irritation is frequent after radiotherapy and this requires caution in women of mental abnormality.

The author says that childbearing is possible after radiotherapy but that radium should never be used upon a woman who may become pregnant as the sclerotic changes predispose to dystocia. X-ray, he thinks, may disturb the structure of an ovum and determine abnormal structure or development of the fetus. It should only be used when hysterectomy is the only alternative.

Carcinoma of the Female Urethra With Notes of Two Cases Treated by Radium. WILLIAM FLETCHER SHAE, M. D., Jour. Obst. & Gynec. 30:215-219, November 2,1923.

THIS is a rare disease of the urethra, only about one hundred cases having so far been reported. The author reviews the literature and presents two case reports.

The growth begins either in the urethral mucous membrane or in the epithelium surrounding the meatus with secondary invasion of the urethra. In the first situation it is found either as an ulcer or an infiltration but in the second it may be either of these or a polypus.

Radium treatment is the only alternative to surgery. Surgery is not very successful but the end-results of radium treatment are not yet established and it is too early to prophesy what they may be. Two cases are reported by the author, in one there was a recurrence after three years and in the other radium treatment was begun in October with a clinical cure and with no return of symptoms in April, 1923.

Radium as a Substitute for Hysterectomy. C. W. WOODALL, M. D., F. A. C. S., Am. J. Obst. & Gynec. 6:734-736, December, 1923.

CONTRA-INDICATIONS for the use of radium *in utero* are given as follows: (a) patient cachectic; (b) fibroids size of a four months' pregnancy or larger, also tumors causing pressure symptoms; (c) (c) cervical fibroids causing distortion of cervical canal; (d) young women, (e) cases having acute pelvic inflammation, abscess, broken down or infected or calcified myomata.

Radium is indicated as follows: (a) for simple fibroids, either subserous, intramural or submucous where the uterus does not extend above the umbilicus, in women who are approaching or have passed the menopause; (b) in endometritis and myometritis without complicating pathologic conditions necessitating a hysterectomy; (c) in so-called idiopathic metrorrhagia; (d) in early carcinoma of the uterus or cervix whether or not a panhysterectomy is to be done; (e) as a palliative.

X-Ray Examination of the Urinary Tract. ROBT. W. A. SALMOND, O. B. E., M. D., Ch. M., Brit. M. J. 2:648-656, October 13, 1923.

NEGATIVE results in the x-ray examination of the urinary tract are almost of equal value with positive ones if the interpreter has sufficient knowledge to make use of them. The success of the examination depends upon proper technique and accurate interpretation. The later factor depends largely upon whether the interpreter has had considerable experience in urological work as well as in radiology.

Exposures must be rapid: only a fraction of a second is best and never more than two or three seconds should be consumed in making the exposure. The coils of the intestine should be displaced to one side or the other by compression, the author uses a pneumatic bag for doing this. The patient should be on a light diet for two days preceding the examination and should have a very light breakfast upon the morning of the examination and an enema should precede the examination. The tube should be a soft one. The examination may be made either with the patient lying upon the face or the back, if on the back the film must be placed so as to include the last two ribs and the top of the iliac crest. It is important to see that the skin is free from papillomata or scars and that it is in close apposition to the film. The entire urinary tract should be done in all cases and the film should show the entire kidney outline, the last two ribs, the transverse processes of the lumbar vertebrae, the outer margin of the psoas muscle and part of the crest of the ileum. The writer uses the unscreened film. If screening is used it should be of the first quality as the slightest flaw will destroy the value of the film. In the examination of the mid-ureters the tube should be well tilted, the patient supine and the opening of the extension tube pointing well into the opening of the pelvis, otherwise certain shadows will be obscured. If the patient is examined from below and lying prone an air cushion should be placed under his thighs.

The use of the Potter-Bucky diaphragm gives much better results. If doubtful shadows are found the examination should be repeated after a few days. The chief value of screen work is to determine the relative movement of a supposed stone shadow to that of the kidney and its direction of movement with respiration.

The above is the routine technique. Special methods are used for special needs, e. g., when it is necessary to know the exact relation of a shadow to some part of the urinary tract or the shape and size of the kidney itself. Pneumoperitoneum is not without danger, the author has had one fatal case in his experience with it. Colon inflation by pumping air in through a rectal tube is a simple and a safe method but it must be done under a screen as only thus can the optimum effect be obtained. Too much air causes conflicting shadows. Pyelography is, however, a most valuable aid when properly carried out. Several pages of the original deal with the interpretation of various types of pathology as shadowed on the x-ray plate.

Radiotherapy in Gynecolgy. W. F. THEODORE HAULTAIN, M. C. M. B., F. R. C. S. E., Edinburgh Med. J. 30:289-296, July, 1923.

RADIOTHERAPY is not an opponent but an aid to the surgeon. There are few cases where opinion as to the best form of treatment is apt to be conflicting.

Radiotherapy is of great use in the menorrhagia of adolescence which cannot be controlled by anything else short of hysterectomy. It is also indicated in many cases of menopausal hemorrhage which cannot be aided by curettage.

In general the author would not use radiotherapy for fibromyomata, its chief role here is in cases complicated by a severe disease such as Bright's or Grave's disease.

When the five year statistics upon radium treatment of carcinoma of the cervix are available the author thinks there will be no shadow of doubt left that radium is the treatment of choice for this lesion.

Radiotherapy is definitely contra-indicated for operable carcinoma of the body of the uterus as operative measures here are so satisfactory.

Neither x-rays nor radium should be applied to a gynecological case until after the patient has been thoroughly examined by a gynecologist, under chloroform if necessary. Also any case of myoma so treated should be examined periodically for one to two years after treatment in case malignancy should develop. Much harm has been wrought by the indiscriminate use of radiotherapy

in complicated cases of fibroids where the proper examination by a competent man has not first been made.

Value of X-Ray in Obstetrics.. J. P. GREENHILL, M. D., Med. Clin., N. A., 7:611-627, September, 1923.

THE FIELD for x-ray in obstetrics is still a new one and has many possibilities.

In the Chicago Lying-in Hospital the x-rays are used to verify opinions concerning pelves, such as contraction, deformities, fractures, separation of the symphysis pubis and healing of the pubiotomized pelvis. They are also used to corroborate suspicion of fetal deformity in utero, and after delivery to verify fracture of the fetal bones and such anomalies as dextrocardia and spina bifida. The use of the rays is not limited to the above uses but may be used for the examination of teeth, sinuses, the gall-bladder and to detect focal infections.

Case reports are presented which include cases of cephalopelvic disproportion, hydrocephalus, tuberculosis of the hip, pubiotomy, separation of the symphisis pubis, fracture of the pubic bone, breech presentation, demonstration of fetal death and of tubal pregnancy.

No harmful results have come to either mother or child in the author's use of the rays.

Malignant Lymphoma (Hodgkin's Disease). A Radiographic Study. LESTER R. WHITAKER, M. D., Arch. Int. Med. 32:538-555, October 1923.

AUTHOR'S conclusions: "The roentgen ray is a feasible measure to employ as an aid to the diagnosis of Hodgkin's disease because the inthrathroacic nodes are often involved in this disease, and the radiographic appearances are fairly characteristic.

"In rare cases in which the lymphoma is confined to the thorax and biopsy is not possible, the roentgen ray may greatly aid the diagnosis.

"Hodgkin's disease is indicated when the radiograph shows homogeneous, roughly lobulated shadows in the mediastinal or hilus regions, which shrink rapidly under roentgen ray treatment. Tuberculosis is the most important condition to differentiate from Hodgkin's disease. Owing to definite differences in pathology and the resulting radiographic appearances, this can be accomplished in the majority of instances.

"The most fruitful method of approach to a study of this kind is by an interpretation of the radiographic appearances according to the pathology of the diseases under consideration."

Surgical Diathermy in the Treatment of Malignant Disease of the Throat. W. S. SYME, M. D., Glasgow Med. J. 99:221-224, April, 1923.

DURING the last two years the author has used diathermy in treating malignancy of the throat and has found that it gives great relief.

More and more, surgical diathermy is being recognized as applicable and preferable to ordinary surgical procedures in malignancies of the mouth and especially in those of the pharynx.

The writer uses a flat plate wrapped in several layers of lint wrung out of saline solution and this is placed under the patient's buttocks. The active pole is in the form of a blunt knife (or a button for small growths), which is plunged into the tissues and the current closed. The blood vessels are coagulated, hence the operation is a bloodless one but when vessels the size of the carotid or the lingual artery are concerned it is better to use a temporary ligature. Complete removal is done at the time of the first operation. If glands are present they are removed later in the usual manner.

The author presented six patients whom he had treated by diathermy and in whom great improvement and relief had been wrought.

The advantages of diathermy are that it is practically bloodless and in disease involving the oropharynx no external operation is required to expose the growth. Absence of shock and pain is also a marked advantage and there is no risk at all of cell implantation as there is in operation.

Treatment of Tuberculous Cervical Adenitis by Radium. E. S. MOLYNEUX, M. R. C. S., Brit. M. J. 2: 865-866, November, 1923.

EARLY excision will often cure a patient but the ordeal is painful, leaves a scar and often the debilitating effect of the operation causes an outbreak on the other side of the neck.

For more than ten years the author has used radium for the treatment of this disease and only one patient of those who conscientiously carried out the treatment failed of apparent cure and all patients were benefited. Scrupulous attention must be paid to the technique, else harm and not good will result.

The author uses flat silver applicators 3 mm. thick and one inch square containing the equivalent of 15 mg. of radium bromide. He uses radium sulphite but in measuring it one speaks in England in terms of radium bromide. The radium is incorporated with a form of cement. The applicator is screened with one mm. of silver, a couple of layers of lint next to this, and two layers of thin gutta percha over the whole. The silver absorbs the alpha and beta rays so that it is the gamma rays that are applied, and the layers of lint and gutta percha absorb the secondary beta rays set up when the gamma rays emerge from the metal screen. The applicator thus filtered is applied to the patient's body, four hours is generally the time employed, and two or more applicators are used so as to cover the entire area at one sitting.

A dose should be applied twice a week to begin with, and once a week when the glands are markedly subsiding, but the effect must be watched and each case judged on its merits as patients vary greatly in their reactions to radium. Mild cases may be cured by two treatments but often months are required to affect a cure. Treatment is continued until all signs of disease have disappeared, except possibly some fibrous nodules.

Radium and Roentgen Ray Treatment of Chronic Lymphatic and Myelocytic Leukemia. HARRY H. BOWING, M. D., Med. Clin. N. A. 7:233-239, July, 1923.

FOR radiotherapeutic purposes the cases are classified into two groups: (1) those having small or scant superficial glandular or splenic enlargement and slight or moderate change in the circulatory blood cells and whose general health is usually good and (2) those having extensive, bulky, superficial glandular or splenic enlargement or both, with sever blood changes. General health in this group may be fair or poor.

The technique of treatment used at the Mayo Clinic is described. Roentgenologic treatment is started early and continued daily until completed. The plan of treatment must be individual and cooperation between clinican and radiologist is imperative.

Improvement is remarkable in some cases and if treatment is judiciously applied all will be benefited.

Injury to the Larynx Induced by X-Ray Treatment. A. VAN ROSSEM, Holland, J. Laryngol. & Otol. 38: 477-478, September, 1923.

THE author reports a case of lymphomata of the neck which received x-ray treatment for this condition. The patient then developed a

hoarseness which disappeared after a few weeks. Six years later the same sort of hoarseness reappeared. No tuberculosis was present at either the beginning or the end of this six-year period. During these six years she had been treated by x-rays for ulceration of the skin of the neck. The ulceration had healed but the skin was thin and the cervical tissues had become very solid. Upon the occasion of dyspnea appearing at the end of the six-year period, the patient entered the hospital for treatment which relieved the condition but three weeks later she died of pneumonia.

Postmortem showed caries of the os hyoideum and the cartilage of her throat was found destroyed. Laryngeal perichondritis was present but no tubercle was found upon microscopy. The author considers that the first x-ray treatment was too severe and that the laryngeal perichondritis resulted from treatment by x-rays.

Marschik reported a similar case in 1921 and he also believes that the non-tuberculous perichondritis resulted from x-ray treatment. He believes that in some individuals the larynx is peculiarly sensitive to x-rays. He believes that the perichrondritis results secondarily from the alterations caused by the x-rays. Marschik, Holzknecht and Holfelder think that at least eight weeks should intervene between x-ray treatments, and Marschik advocates observation of the patient for one year. The author would observe the patient for a longer period in the light of the case he himself reports here.

The Silhouette Radiogram. A. P. BERTWISTLE, M. B., Lancet 205: 783. October 6, 1923.

AN ordinary radiogram is a silhouette of bone, the one here described is a silhouette of bone and flesh.

The author finds it of value to outline the soft part by scratching the negative with a pin, carefully following the skin outline. He then makes a puncture and blocks out the background with india ink. This idea may be applied to demonstrate the congenital absence of muscles, muscular wasting as in a tubercular knee, and the relationship of external sinuses to surrounding tissues. The sinuses must be injected with bismuth to do this. Tuberculous dactylis, ostitis deformans and rickets all show the characteristic contour as well as the accompanying bony lesion. In a fractured ulna the relationship of the callus to the surrounding parts can be shown and one can estimate to what extent the swelling is due to a bone condition and to what extent it is due to surrounding tissue damage.

Equipping the Radium Department. A Description of the Radiological Department of Philadelphia General Hospital. J. L. WEATHERWAX, M. A., Hospital Management, 16: 52-53, July, 1923.

THE laboratory of this hospital is fashioned after that of Memorial Hospital, New York City but certain improvements have been added. The laboratory has been in use for more than a year and has proved very satisfactory.

It consists of an emanation room with apparatus to collect the emanation from two grams of radium, a measuring room where the emanation is properly evaluated, and a shop with precision machinery, for making various kinds of apparatus for carrying on research, and for constructing applicators. There is a second measuring room and a preparation room in the radiologic clinic.

The radium is kept in a safe with a water cooler back of the bulbs containing the radium. The safe is lead lined, has two combinations and an outside wooden casing locked by a key. Just inside this casing the safe is wired with connections to a protective agency in the city so that any attempt at robbery would be instantly known.

The apparatus for collecting the emanation is constructed in duplicate so that if one unit meets with accident emanation can be collected with the other. It is also so constructed that the operator works at a distance from the emanation and behind a screen of one-half inch lead.

Other adjuncts are a bench for making capillary tubes and for other glass blowing. A small gas flame for cutting up emanation tubes is so shielded by lead and lead glass that the operator must use forceps ten to twelve inches long in cutting the tubes.

The capillary tubes are taken to the third floor for measuring in order to insure great enough distance from the emanation room that the electroscope will not be affected. The electroscope is standardized with 25.24 mg. radium bromide before each set of measurements. Fifty or 60 fare tubes cut into 3 mm. lengths are measured together and compared with the measurements of the standard, and the total strength of all the tubes is computed. These tubes are then measured individually in the measurement room of the hospital. There is an ionization chamber and lead protected box for the tubes while measuring. From the total strength of all the tubes and from the relative strength of each tube the strength of each is estimated in millicuries. Emanation tubes, both glass and silver, are kept in a lead lined safe.

Deep Therapy Hospital Service. W. A. EVANS, M. D., Hospital Management, 2:50-51, January, 1923.

THE whole question of deep therapy is one of theorization, experimentation and observation. The three theories regarding the action of x-rays upon bodily tissues are (1) direct action on the cells by reason of the primary rays; (2) secondary radiation developed in the body; (3) a separation of electrons in the cells during which process heat develops. The history of x-ray therapy has, in the main, been a history of the x-ray machine.

At Harper Hospital the transformer is in a small room in the center of the treatment room, and the walls surrounding the transformer are sound proof. The high tension current is carried to two large cylinders of mahogany and lead, the latter covered both inside and out by wood, the wood absorbing the secondary radiation. The cylinders have fans which provide a continuous circulation of cool air, carrying out the gases and keeping the tubes cool. The cooling apparatus is sufficient to permit the tubes to be used for from ten to twelve hours with only a four degree change in temperature.

The patient is protected by lead in the cylinders and by lead rubber laid across the body and supported by a frame to keep the weight off the patient. The walls are sound proof to protect against the noise. The operator is protected by a lead lined booth, which has a covering of wood as have the cylinders. Lead glass windows are used in the booth. Good ventilation of this booth is very essential.

A second installation is being planned which will provide for treatment of the patient from three directions at the same time. A tube will be placed above the patient, one below the patient and a third one from the side. This installation, as does the one now in use, permits the treatment of two patients at the same time.

X-Ray Film Storage. THOMAS K. GRUBER, M. D., Hospital Management, 16:48-49, December, 1923.

FEW hospitals realize the potential danger in the handling of films which the author says are "veritable dynamite." Two recent fires, one of them disastrous to

life, are reported as due to faulty storage of films. Adequate safeguards must be employed to avoid this risk.

A Water Cooled High-Voltage X-Ray Tube. W. D. COOLIDGE, Ph. D. and C. N. MOORE. Am. J. Roentgenol. 10:884-889, November, 1923.

THE authors refer to their paper describing an experimental tube in which the anode consists of a solid plate of tungsten in the form of a circular disc four inches in diameter, the tube being operated in water cooled oil and running steadily as much as 50 ma. at 200,000 volts. (See Journal of Radiology, page 9, January, 1924.)

When these tubes were operated continuously it was found, however, that the inner surface of the glass became roughened locally and serious erosion developed at places. To remedy this objection work was undertaken and was carried to a successful conclusion.

As a result a tube was perfected which satisfactorily handles as much as 50 ma. at 250,000 volts. The authors say of it: "The tube can also be used with the lower values of current and voltage now generally employed, and experience may show that it has a sufficiently longer life than that of the Universal type high-voltage tube to justify the added complications inherent in water cooling. The distribution in intensity in the radiated tissues will be somewhat affected by the increase in the size of the focal spot over that ordinarily employed. The same consideration which may make the tube interesting for medical application applies in the field of metal radiography also. The tube in its present state of development has a focal spot which is large for radiographic work. It seems probable, however, that a similar tube of equal capacity could be developed with a considerably smaller focal spot."

The Use of Isodosis Curves in X-Ray Therapy. CHARLES GOTTLIEB, M. D., Am. J. Roentgenol. 10:896-901, November, 1923.

THE author says that at a recent convention of the German Roentgen Ray Society considerable doubt was expressed as to the correctness of the Dessauer measurements. Dr. Holfelder presented results of measurements made by himself seemingly proving the incorrectness of the Dessauer charts and the author of this paper made confirmatory experiments which he claims uphold Holfelder's views. The forms of the Holfelder curves differ greatly from those of Dessauer, the most salient differences are thus described: "(1) According to Dessauer, the main primary cone is surrounded with a very wide and only slightly weaker stray field. The primary cone, according to the Holfelder experiments, is sharply defined, and shows, even with the diaphragm placed at a considerable distance from the surface of the water, only a very narrow transitory field which can be well explained to be due to a partial shadow. The stray field around the primary cone is of an extremely small intensity when compared to the intensity of the primary cone. This is so marked that the neglecting of the stray field in practical use can never cause x-ray burns, neither can the stray field be used for therapeutic purposes as stated by Dessauer and his followers. (2) The Dessauer curves show a divergence below the surface. The stray fields of the Holfelder curves show a contraction at the surface, and a second very clear contraction at larger depths of the phantom. (3) The per cent intensity values at depths appear, according to Dessauer's data, to be too high. It was impossible to reach such values when making the tests, even with the highest available voltage. Since Dessauer made his experiments with apparatus of older types, it seems improbable that he would have had any harder rays at his disposal than the ones we used in our experiments. (4) The change of intensity toward depth follows in the Dessauer curves approximately the shape of a logarithmic curve while the Holfelder curves and also my tests have in every case shown a very prominent hump at the beginning of the curve."

A Comparative Study of the Efficiency of Various Filter Materials. ARTHUR W. ERSKINE, M. D. and SCOTT W. SMITH, M. S., Am. J. Roentgenol. 10:881-883, November, 1923.

FILTER efficiency depends upon the wave-lengths in the filtered beam and penetration is inversely proportional to wave-lengths. Therefore the relative efficiency of various filter materials may be determined by a comparison of their effects on penetration.

Such a comparison was made by measuring the effect of various filters on the ratio between the surface and depth intensities in a water phantom, the x-rays measured being produced under fixed conditions.

The most efficient elements studied were copper, iron, nickel and zinc, ranging in atomic weight from 55 to 65, and in atomic numbers from 25 to 30. The most efficient alloys studied were brass and monel metal (alloys of the same element). Because of the efficiency and desirable physical properties of the alloys the authors believe that these should be studied further.

Roentgen Ray Intoxication. Bacterial Invasion of the Blood Stream as Influenced by X-Ray Destruction of the Mucosal Epithelium of the Small Intestine. S. L. WARREN, M. D., and G. H. WHIPPLE, M. D., J. Exper. Med. 38-713-721, December, 1923.

DOGS were used in these experiments. After radiation they were killed and cultures made from various organs. The study is as yet incomplete and the report is a preliminary one. The authors' conclusions read: "The x-ray has a specific effect upon the epithelium lining the crypts and covering the villi of the small intestine. A suitable dose of x-ray will destroy this epithelium in large measure, leaving empty crypts and naked villi exposed to swarms of bacteria in the intestine. Subsequently one does not observe an overwhelming invasion of the tissues, lymph and blood by intestinal bacteria. It seems obvious therefore that the intestinal epithelium is not the all important barrier which protects the tissues from invasion by intestinal bacteria."

Roentgen Ray Intoxiation. The Path of a Beam of Hard Rays in the Living Organism. S. L. WARREN, M. D. and G. H. WHIPPLE, M. D. J. Exper. Med. 38:731-738, December 1923.

DO HARD x-rays follow a straight and narrow path from the target through the tissues? Do they suffer from reflection or refraction? What factor is secondary radiation in the treatment of disease and does it exert a toxic effect on tissue cells or tumor cells outside the direct pathway of the hard rays? Answers to these questions were sought by animal experimentation (dogs used). The experiments and discussion of them are very interesting. The author's summary reads as follows:

"X-rays which injure intestinal epithelium (and presumably other body or tissue or tumor cells) travel in straight lines from the target through the living tissues, forming a cone or beam of rays as controlled by impervious screens.

"It is probable that secondary radiation is formed, especially deep

in the body tissues, but such radiation does no injury to intestinal epithelium outside of the cone or path of radiation.

"Lesions in the stomach and intestine may be confidently predicted from a knowledge of the size and form of the cone or beam of x-rays given over the abdomen. These lesions even more than skin burns do not heal and may in fact go on after many weeks to perforation.

"Even in the depths of the abdomen the duodenal lesions are as clean-cut as a peptic ulcer, indicating the lack of dispersion or scattering of the primary or secondary rays in passage through the living tissues. Transition from normal to necrotic mucosa rarely occupies more than two or three millimeters and can be observed in a single low power microscopic field."

Roentgen Ray Intoxication. The Cumulative Effect or Summation of X-Ray Exposures Given at Varying Intervals. S. L. WARREN, M. D. and G. H. WHIPPLE, M. D., J. Exper. Med. 38:725-730, December 1923.

AN AVERAGE maximum sublethal dose of 320 ma. min., divided into certain fractures, was administered over the abdomen of a series of dogs at different intervals. The machine used was a standard auto-transformer at an E. M. F. of 85 to 95 kv., spark-gap 21 to 23.7 cm. between sharp points. A medium focus Coolidge tube was set at skin target distance of 25 cm. Filament current was usually 8 ma. and dosage was computed in milliampere minutes. Filter was 2 mm. Al, no screens. Complete anatomical and histological studies were made in each case at autopsy.

It was found that a single large dose of x-rays over the abdomen caused a definite injury of the mucosa of the small intestine and the x-ray toxemia paralleled in severity the injury caused the mucosa. The toxemia lasted four to six days if the x-ray dose was sublethal. Subsequent doses given during the period of toxemia gave a recognizable evidence of cumulative effect. Small or repeated doses of radiation given within a five or six day period caused practically the same cell injury and clinical intoxication as a single dose representing the sum of the small doses expressed in ma. minutes. Doses of radiation given at six day intervals, or longer intervals, showed no evidence of summation. The authors believe that the reaction of this relatively sensitive intestinal epithelium to radiation may be similar to the reaction of certain deep lying tumor tissues to x-ray therapy.

Roentgen Ray Intoxication. Intestinal Lesions and Acute Intoxication Produced by Radiation in a Variety of Animals. S. L. WARREN M. D., and G. H. WHIPPLE, M D., J. Exper. Med. 38:741-751, December 1923.

COMMON laboratory animals were found to be about equally sensitive to the x-rays given over the abdomen, the rat and guinea pig were found slightly more sensitive than the dog, cat or rabbit. Large amounts of radiation were applied in single doses and the smallest dose which was found would kill an animal in the shortest time is called the minimal lethal dose. The same standard technique was used as described in the preceding abstract. The clinical reaction following the minimum lethal dose was similar in each animal and the intestinal pathology almost identical.

By contrast birds, frogs and reptiles are very resistent and will tolerate two or three times the dose lethal to the others. No explanation is yet found for this.

These data strengthen the authors' belief "in the scattered and incomplete observations on human cases which indicate that the human intestinal tract is likewise sensitive to radiation. This fact must be given consideration in conditions where abdominal or pelvic radiation is being used because such injury done to intestinal epithelium is always serious and in some cases irreparable."

Value of Diagnostic X-ray in Neoplasms of the Urinary Bladder. ROBERT E. FRICKE, M. D., *Howard A. Kelly Hospital*, Baltimore.

EVERY PATIENT having symptoms or signs suggestive of bladder growth should have an x-ray examination by means of bismuth injected into the bladder.

Two case reports are submitted and the following conclusions are drawn: (1) Bladder tumors that are bleeding freely and have been bleeding severely for a long time may present serious obstacles and require drastic measures. (2) In the usual case diagnosed at an earlier stage splendid results can be obtained with radium as the growth may be aggressively radiated through several channels with an immediate response either by implantation of spicules of emanation which remain permanently in the growth or by direct application, external radiation over the abdomen or radium applied through the anterior vaginal wall. (3) Accurate diagnosis should precede treatment.

General Practice and X-Rays. By ALICE VANCE KNOX, M. B., B. Ch. and ROBERT KNOX, M. D., C. M., M. R. C. S., L. R. C. P. MacMillan Co. Price $3.50.

THIS IS a 12mo book, cloth bound, 32 full page plates, 56 diagrams. It was first published in 1921 by Black of London. American agents are the Macmillan houses in both New York and Toronto.

Part I consists of 126 pages written by Alice Vance Knox. Part II consists of 80 pages by Robert Knox. Part I treats of (1) the sphere of usefulness of x-rays in general practice; (2) x-rays in diagnosis; (3) x-rays in diagnosis and treatment of diseases of children and (4) x-rays in treatment.

Part II is upon the discovery and development of x-rays and deals with the physics of x-rays and describes the various apparatus. The last ten pages are devoted to stereoscopic radiography.

The value of this book is sufficiently guaranteed by the authors' reputation in the radiological field.